PREHISTORIC INVENTORY
MIDDLEBOROUGH, MASSACHUSETTS

Dr. Curtiss Hoffman
Principal Investigator

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I. MANAGEMENT SUMMARY

This report describes a project which was undertaken in 1991 to study the prehistoric archaeological resources of the Town of Middleborough, Massachusetts. The Middleborough Prehistoric Inventory Project gathered information from public and private sources on site locations and prehistoric artifact distributions. This information has been placed on computer files and color slides for future access, for research, educational, and management purposes.

Archaeological sites are sensitive, non-renewable resources. They may contain significant information concerning the behavior and adaptations of past peoples in the form of tools, debris from tool-making, food remains, and the physical remains of the people themselves. While most portions of the New England landscape have been subjected to disturbance by plowing over the past 350 years, many sites contain undisturbed prehistoric materials beneath the plow zone, and some of the more remote locations have escaped plowing. These undisturbed deposits are of particular importance to the study of past lifeways because the positions of material remains in them are more or less intact, and their interrelationship can inform us much more than isolated recoveries. It is of importance to any locality that as much of this prehistoric heritage be preserved <u>in the ground</u> as possible, since techniques of archaeological recovery are continually being improved. It is for this reason that archaeological

resources were included in the relevant Federal and state environmental protection legislation.

Research for this project has included interviewing collectors, reviewing documents, and inventorying and photographing artifacts from various parts of the Town. A total of 5080 artifacts were entered into a computer-based inventory, keyed to individual photographic slide images. This has resulted in the identification of 120 previously unreported prehistoric sites, as well as the confirmation of 39 known sites within the town. The project also included the taking of a pollen core in a swamp north of Pocksha Pond to obtain a sequence of vegetative communities over time. This enables us to understand the relationship of prehistoric occupations to environmental changes.

On the basis of the information gathered from the research phase of the project, a model of prehistoric site distribution has been constructed. This model takes into account six environmental variables (aspect, distance from water, hypsometric integral, stream rank, soil type, and slope) and measures them against five cultural variables (site age, site function, complexity, redundancy, and intensity). Correlation of the last three cultural variables with the distance of a site to its nearest neighbor was also performed. The resulting tables allow for the construction of hypotheses about the distribution of prehistoric cultural patterns throughout the Town of Middleborough.

The goal of this study is a series of recommendations to the Town as to how best to monitor and conserve its prehistoric cultural resources, accompanied by a detailed map based upon the above predictive model of site location which can be used by town commissions and boards in estimating the archaeological sensitivity of any portion of the Town.

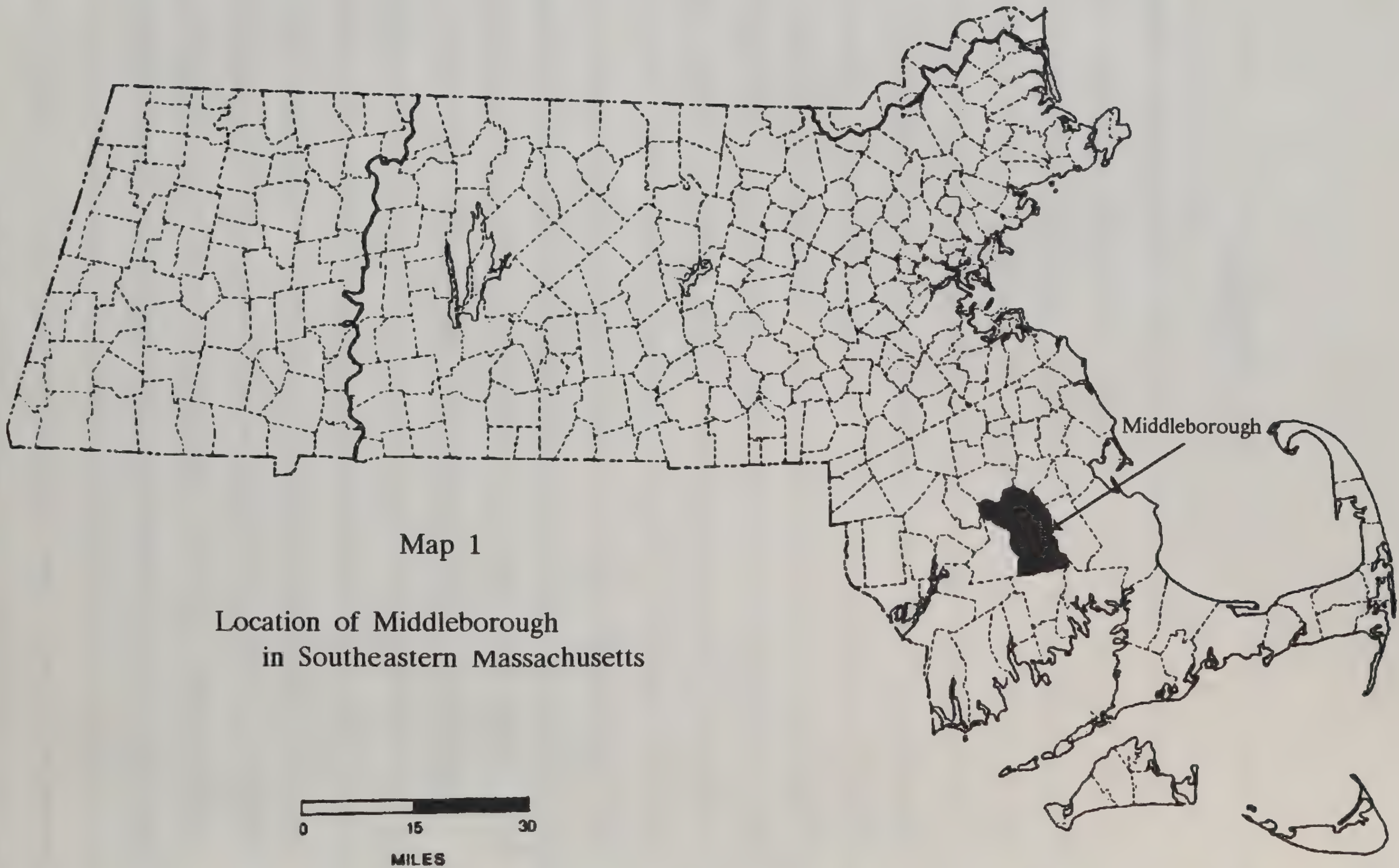
In summary, the study has produced significant information demonstrating the importance of Middleborough as a central place throughout 10,000 years of New England prehistory. It has shown that certain areas of the Town, particularly along the Nemasket and Taunton Rivers, were occupied consistently throughout prehistory, while other areas were occupied more sporadically. Sites in the riverine areas also display a greater complexity of activity patterns than do the more isolated locations, indicating a more concentrated and varied population. There are high points of occupation, relative to the rest of the region of southern New England, during the Early Archaic (9,000 - 8,000 years ago), Transitional Archaic (4,000 - 3,000 years ago), and Early Woodland (3,000 - 2,000 years ago) phases. The latter two phases are strongly related to ceremonial activities including ritual burials and the production of rock carvings.

This information will allow the Town to produce nominations of both individual sites and districts to the National Register of Historic Places, thereby affording them a level of official recognition and protection. In addition, it will provide Town Boards and Commissions with a management tool which can be used to monitor development and to ensure that appropriate archaeological investigations are performed in advance of construction or other land surface alterations. It also allows archaeologists and other students of historical processes to develop regional models of social change which can contribute significantly to our understanding of the past and of our place in the natural and social worlds, which is the aim of anthropological archaeology.

II. INTRODUCTION

The Town of Middleborough is located in Plymouth County, Massachusetts, on the coastal plain (see Map 1). Most of the town is drained by the Taunton River, which forms part of its northern and western boundary, and two of its major tributaries, the Nemasket and the Winnetuxet. The southwestern boundary of the town runs through four of the large ponds of the Lakeville Ponds complex: Assawompsett, Pocksha, Great Quittacas, and Little Quittacas. The ponds currently are connected through a canal dug in the channel of Black Brook to the Mattapoisett River, but they also are the source of the Nemasket, and at one time following the glacial retreat this southern water route formed the major direction of flow for the ponds (Lougee, quoted in Robbins 1981). The southeastern portion of the town is drained by the Weweantic River, which forms part of its eastern boundary. A small area in the southern portion of the town is drained by the headwater tributaries of the Sippican River. Two other large ponds, Tispaquin and Woods, are connected via Fall Brook to the Nemasket River.

Middleborough is the second largest town in the Commonwealth in area, and was incorporated in 1669, as a result of several purchases from Native Americans (Weston 1906). Middleborough has long been known both for its scenic beauty and its special importance to Native Americans throughout the 10,500 years of prehistory. Large collections of artifacts, including spectacularly large ceremonial blades, were the highlight of the displayed collections from the Wapanucket site in the Massachusetts Archaeological Society's Bronson Museum in Attleborough, along with detailed dioramas of that settlement on the shores of Assawompsett Pond. These collections still form an important core of the Society's collections in its new home in Middleborough.



Map 1

Location of Middleborough
in Southeastern Massachusetts

During the first six months of 1991, the author conducted an inventory of prehistoric sites in the Town of Middleborough for the Middleborough Historical Commission and the Middleborough Natural Resources Preservation Committee. The survey team of current and recent Bridgewater State College students in the Public Archaeology Concentration produced a computer inventory and slide file of 5080 artifacts from the town, derived from 69 collections in both private and public hands. Coupled with initial research at the Massachusetts Historical Commission (henceforth M.H.C.), this resulted in an inventory of 159 prehistoric sites, of which 120 were previously unreported in the prehistoric site inventory of the Massachusetts Historical Commission (see Map 2). At the same time, a pollen core was taken from a small swamp northwest of Pocksha Pond in Middleborough, which has been analyzed by Dr. Gerald Kelso of the National Parks Service, to provide a record of late Pleistocene and Holocene climactic changes in the area (see Appendix B).

The goal of this study is to provide the Town committees referred to above with a model of prehistoric land use over the estimated 10,500 years of prehistory. The model is based upon artifact typology, site function, choice of lithic materials, site clustering, complexity, frequency of occupation, and intensity of occupation. These cultural variables are measured against the environmental parameters of soil type, aspect, proximity to water, slope, stream rank, and hypsometric integral. The model also takes into account several pre-existing models of site location in southeastern Massachusetts (Roberston and Robertson 1978, Snow 1980, Thorbahn et al. 1980, Talmage 1982, Thorbahn 1984, Weinstein 1985, Hallaren 1988, Hoffman 1989a). The purpose of the model is to provide the Town with a means of predicting the sensitivity of any

location at which development or other major land surface alteration, whether public or private requiring public oversight, may be planned.

III. PRIOR RESEARCH INTO MIDDLEBOROUGH PREHISTORY

Antiquarian interest in Middleborough prehistory goes back at least 120 years. The naturalist J.W.P. Jenks, who lived in Middleborough and was associated with the famous geologist Louis Agassiz, engaged in some artifact collection during the last quarter of the 19th Century, along with his biological studies. A pestle bearing his handwritten label in the Robbins Museum collection is attributed to Middleborough, unfortunately without tighter provenience. Most of his collection was donated to Brown University upon his death, and subsequently was distributed by them to the Roger Williams Museum in Providence and the Haffenreffer Museum in Bristol, Rhode Island. Inquiries at these two institutions have been made, but the Roger Williams Museum reports no artifacts from the Jenks collection, and the Haffenreffer is unable to determine whether they have any, as they are currently inventorying their collections.

During the first four decades of the twentieth century, several individuals developed an interest in collecting artifacts from Middleborough sites. These included most notably William Greene, Joseph Prenzo, and Howard Mandell. These men, along with several others, formed the Middleborough Anthropological Society in the late 1930's, in order to regularize their collecting activities. They conducted a well-publicized dig at the sites now known as Wapanucket 1 and 2, as well as less publicized excavations at Indian Hill and the Wood site, and probably other locations also. From 1935 through 1939 Greene maintained a notebook in which he recorded his finds, along with increasingly accurate line drawings. This is currently in the possession of William Taylor, who kindly allowed the Principal Investigator to make a xerox copy. Prenzo prepared a map

of known site locations on a copy of a 15 minute U.S.G.S. Quadrangle, and a copy of this map is also in the possession of the inventory.

In 1939, several groups of amateurs from various parts of the state, including members of the Middleborough Anthropological Society, met with some professional archaeologists interested in New England archaeology at the R. S. Peabody Foundation in Andover, Massachusetts. The result of this meeting was the formation of the Massachusetts Archaeological Society, and the adoption of a highly ethical statement of purpose which was to guide responsible archaeological operations in the Commonwealth thereafter. While some of the Middleborough group continued to dig at Wapanucket throughout the 1940's, others worked along with the newly formed Warren K. Moorehead Chapter of the Society at several excavations in southeastern Massachusetts, including the Titicut Site across the Taunton River from Fort Hill (Robbins 1967). They performed some preliminary testing at Fort Hill at this time, and Greene published two articles in the early issues of the Society's Bulletin (1942, 1961). Howard Mandell served as Society president from 1951-1954. Mandell also donated at least part of his collection from Wapanucket to the Massachusetts Archaeological Society.

In 1952, as the result of a schism within the Moorehead Chapter, a group broke away to form the Cohannet Chapter. This group, which included Dr. Maurice Robbins, the principal investigator of the Titicut site, began work in that year at Wapanucket, and remained there for the next 30 years, excavating at 8 separate loci and recovering large quantities of information in reasonably good order. This resulted in several publications (Robbins 1958, 1963, 1968, 1981), the most important of which is Robbins' 1981 monograph. Two generations of amateur archaeologists were trained at this site in controlled methods of excavation and recording. Their methods were innovative and in some ways ahead

of their time, although there were some categories of data which we today wish they had recovered (especially flakes and casual tools). They also permitted excavators to keep their finds after preliminary inventorying, which has resulted in the disappearance of a large part of the collection. However, it is certain that the excavations at Wapanucket put Middleborough on the map, in terms of its prehistory -- quite literally. It is one of the few sites in Massachusetts that continues to be included in continent-wide prehistories (e.g. Fagan 1991), and it is the only prehistoric site in Middleborough currently listed in the National Register of Historic Places.

During the same period, surface collecting and limited excavation took place in other locations in town, most notably by William Taylor and others at Fort Hill and Taylor Farm, and by Ray Seamans, Jr. of Carver at sites in the eastern part of town. Taylor has published several articles on his findings in the Bulletin of the Massachusetts Archaeological Society (1976, 1977, 1982), and additional articles on the Fort Hill area appeared under the pens of Karl Dodge (1953) and of the Bulletin's long-time editor, William S. Fowler (1973, 1974, 1982). Most of the larger collections included in the current inventory were probably acquired during this period.

Robbins resigned as dig director at Wapanucket in 1980, convinced that further work at the Wapanucket site would be redundant. The Cohannet Chapter continued to excavate there for another three years, before moving to the Pratt Farm site, called at the time the Nemasket Village site (Note: in this inventory the site is referred to as Pratt Farm 1, because two other prehistoric loci on the Pratt Farm property have since been discovered.). They worked there for two years, and were disappointed not to find evidence of complex occupation that would confirm the impression that this was the site of the Contact period

village. The Cohannet Chapter moved its operations thereafter to sites outside of Middleborough, although they participated in a systematic surface collection at the Soccer Field site in 1984 with Dr. Jordan Kerber, then of the Massachusetts Historical Commission. During this period, Robbins published a series of brief monographs on Contact period Indian trails in southeastern Massachusetts, several of which passed through Middleborough (Robbins 1984a, 1984b, 1984c, 1984d). Collecting of surface finds has continued throughout the 1980's and into the 1990's, and a few collectors brought several fresh batches of material into the Robbins Museum during the course of the inventory.

During the 1980's, cultural resource management came to Middleborough, as the result of antiquities and environmental legislation at the state and Federal levels mandating archaeological work in locations threatened by development on public lands or where public funds or public permits are involved. Between 1980 and 1990, eight archaeological surveys were performed in advance of construction of power lines, shopping malls, industrial parks, and housing developments (including Holstein 1988, Gorman and Dalton 1986, Pagoulatos and Leveillee 1988, Davin 1986, King and Vogt 1989, Pagoulatos 1987, Hoffman 1989a). These surveys were performed by teams of professional archaeologists and students, sometimes with participation by amateur archaeologists as well. All of these surveys were at the reconnaisance/ intensive level, at which normally a small number of small-sized test units are opened in order to determine the presence or absence of cultural remains, and to obtain a preliminary impression of their age and spatial distribution. In each case the number of recoveries was small, and in the opinion of the Principal Investigators did not warrant further testing. In addition, there have been two studies of surface collections by M.H.C. staff

(Kerber 1986, Mahlstedt 1985). All of these investigations have added significant data to our knowledge of Middleborough's prehistory.

Finally, two large-scale projects have been undertaken in 1991: the present inventory and a project undertaken by the Office of Public Archaeology at Boston University (Elia 1990). The latter project is funded by the City of New Bedford and seeks to inventory sites around the Lakeville Ponds, or the "Assawompsett Pond Complex", in Lakeville, Freetown, and Rochester as well as in Middleborough. The author has maintained communication with the survey team from O.P.A. and data has been shared between the two endeavors.

IV. RESEARCH DESIGN

A. Research Goals:

The Town of Middleborough has undertaken an ambitious project to inventory its historical and environmental resources over the past 15 years. Studies so far completed include an open-space plan (Barton and Fisher 1974), a conservation and recreation plan (Middleborough Conservation Commission and SERPEDD 1981), an open space and recreation plan (I.E.P., Inc. 1987), and an inventory of historic houses with a view to creating National Register districts. Upon completing its inventory of historic properties under an M.H.C. Survey and Planning Grant in 1989, the Town was made aware of its need to identify areas of prehistoric cultural sensitivity also, in such a way that Town boards and commissions would be able to react expeditiously and comprehensively when proposals for development or other ground surface alteration were submitted. Even in areas where no sites are currently known, a predictive model was needed that would allow for a reasonable decision process about whether or not to require archaeological testing, and at what intensity. Moreover, the decisions needed to be authoritative enough to meet with approval from the Massachusetts Historical Commission.

In order to accomplish this goal, it was realized that it would not be sufficient to rely on already existing information on site locations or contents. This information was a valuable starting place, but it is not precise enough to make reasoned judgements. First of all, it must be understood that, like ourselves, the prehistoric inhabitants of Middleborough used the entire landscape for one purpose or another. As noted above, the history of collecting in Middleborough, as in most other parts of New England, tends to be restricted to locations of obvious campsites, most of them close to the ponds and rivers.

This produced an inventory of 22 sites in the files of the Massachusetts Archaeological Society (Note: for the purposes of this survey, the Wapanucket locus, 19PL203, has been subdivided into 10 separate sites: the 8 numbered loci, the beach component, and a group whose exact provenience within the Wapanucket site was unspecified). These sites were clearly grouped into three clusters, all centered on water resources: a cluster on Assawompsett Pond (including some sites on the Lakeville side of the Nemasket River), a cluster near the great bend of the Nemasket River near the center of town (the Nemasket cluster), and a cluster around Fort Hill (also including the Titicut and Seaver Farm sites on the Bridgewater side of the Taunton River). These clusters were all noted by Weston (1906) as loci of Contact period activity, and have served as foci for artifact collecting activity for many years.

However, this represents only a part of the seasonal strategy of the prehistoric inhabitants, who migrated throughout the course of the year. Artifact inventories from the obvious sites are likely to be larger quantitatively, but not necessarily representative qualitatively, of the range of prehistoric behaviors, which it was the goal of the inventory program to document. Furthermore, it is important to recall that Middleborough already has 9000 years of documented prehistory, during which time the patterns of settlement and land use were expected to have changed repeatedly, due to both environmental and social factors. It was therefore necessary to establish these patterns, on the basis of both environmental data and artifact inventories.

B. Evaluation of Earlier Models:

Several researchers have attempted to describe settlement patterns in southeastern New England. Some of these are considerably more applicable to the

present inventory than others. The present section briefly reviews the main contributions that each of these models has made to this study.

Robertson and Roberston (1978) addressed the distribution of sites within a regional setting, mostly based upon the parameters of slope, drainage, and proximity to water. They found that there is a high correlation (c. 81%) of prehistoric site frequencies with locations on slopes $\leq$ 15 degrees, within 200 feet of water, and within 100 feet above the nearest water source. While their model also collected data on soil types, absolute elevation, and other variables, these were not found to have as good a correlation with the site locations in their sample.

Thorbahn, Leparto, Cox, and Simon (1980) generated a much more sophisticated model of site location within southeastern Massachusetts, heavily based upon statistical testing and using as its sample the sites then known from M.H.C. files. This model considered 16 variables, including elevation, aspect, distance to water, stream rank, soil type, vegetation, and a number of combined variables illustrating niche diversity. They produced 3 ranked categories for each variable, and rated 749 sites, including coastal/estuarine, riverine, and upland locations. It should be emphasized that this model is highly technical in its statistical permutations, which makes it somewhat difficult to follow the logic of parameter definition and analysis, but the researchers did achieve resolution of the various defining parameters into a coherent set of hypotheses which can be used as reasonably accurate predictors of site location. Interestingly, they found that the intuitive parameters such as those proposed by the Robertsons did not necessarily serve as good predictors. Instead, they proposed an 1.6 km. diameter cachement zone for each site, and found that a fairly high number of sites were located at the headwaters of drainages, up to a

distance of 300 m. from water. High densities of sites were found rather uniformly throughout these zones, where soils were xerophytic (well-drained).

Snow (1980) and Weinstein (1985) have provided models of seasonality in terms of settlement patterning within southeastern Massachusetts, based largely upon the Contact period records made by Europeans. However, both scholars attempted to retroject this pattern into the prehistoric past. They provide valuable information on differing activity patterns and the ways in which these might be expected to appear in the archaeological record. Their models are essentially descriptive rather than quantitative.

Talmage (1982) proposed a core-periphery model for the study of prehistoric site distributions in southeastern Massachusetts. This probably derived from the historic period studies accompanying her paper, and has remained a topic of considerable debate in New England archaeological circles ever since (e.g. Mrozowski 1990). Whether or not hunter-gatherers can be described as operating in a true core-periphery fashion, it certainly does seem to be the case that site distributions of all periods in southeastern Massachusetts are clustered into what resemble cores, while there are other sites distributed thinly in perhipheral areas. Talmage's study also proposed a series of research questions for the region, including specified temporal studies of the Late Archaic and Terminal Archaic/Early Woodland transition (in this report the term "Transitional Archaic" is used in preference to "Terminal Archaic."), analysis of the quartz industry, comparisons between coastal and interior settlement systems, and examination of site size and structure relative to changes in social organization.

Thorbahn (1984) elaborated on this model and added some quantitative measures of it, including nearest-neighbor analysis and density per 25 square

km. This allowed him to confirm that clustering at choice locations has very great antiquity in New England, and that the locations of cores have not changed substantially over the past 10,500 years. He also posited the existence of a third type of area, corridors, and attempted to find correlations between these three locations and environmental parameters such as those described in his earlier co-written article. Strangely, the sites on the Middleborough side of the Taunton River in the Fort Hill-Titicut cluster were not included.

Hallaren (1988) contributed the first thorough description of sites of the Paleo-Indian and Early Archaic phases in the upper Taunton and adjacent North River drainages. Following Campbell (1968), he describes five site types occupied for different purposes during the early Holocene: base camps, isolated winter family camps, fishing/hunting camps, special function camps, and trading stations distant from the above. This model is descriptive, but Hallaren does give examples of each type from the early phases of occupation of the Taunton River, for the most part upstream of Middleborough.

Finally, the Principal Investigator (1989a) proposed a similar model for predicting site locations in marginal areas in southeastern Massachusetts, based upon distributions on U.S.G.S. quadrangles either within 5 km. of the project area of 19PL589-598 or in similar environmental locations within 15 km. of this location. Six site types were defined: large seasonal or semi-permanent base camps, specialized burial sites, short-term campsites, hunting sites, quarries, and isolated find spots. This study accurately predicted that the sites within the project area would be either hunting sites or isolated find spots.

C. Methodology:

The specific strategies chosen to implement the research goals of the inventory were four in number. First, the author consulted with the Commission and the Committee, as well as other individuals in town and the Massachusetts Historical Commission, to obtain maps of known prehistoric site locations. The Massachusetts Archaeological Society files had been copied into the M.H.C. inventory during the 1970's and included 23 sites with M.H.C. inventory numbers. Since that time, the cultural resource management surveys and studies of surface collections mentioned above have added 18 numbered sites to the M.H.C. inventory. However, some of these site locations had no recorded artifacts, and the inventory was still considered anemic, especially for the southern and western portions of the town.

Second, a pollen core was taken from a location selected by Dr. Gerald Kelso, a senior palynologist working for the U.S. National Park Service regional office in Charlestown, Massachusetts. This work was performed in a small marsh northwest of Pocksha Pond (see Map 14), because of its isolation from the pond and relatively deep sediments. The extraction team consisted of Dr. Kelso, the author, Joe Freitas, Dan Govoni, and Ray Dumas, with assistance from Caroline Maguire, Kim Bryan, Janet Griffith, and Kathleen Anderson. The core was analyzed and radiocarbon samples were extracted from key points within it. This provides a detailed sequence of environmental changes on both the regional and local scale. It should be pointed out that local microenvironmental events can play an important role in choice of settlement locations, in terms of when potential sites became available for occupation and what types of adaptive strategies would have been most effective over time. For example, the nearest

pollen core to Middleborough, from Lake Nippenicket in Bridgewater, is highly unusual for the period 4,000 - 3,000 B.P. (Bradshaw et al., 1982), and it was considered important to determine whether the drought event indicated by that core was replicated in Middleborough.

The third, and most labor-intensive part of the project involved an inventory of artifacts from known sites in Middleborough. Kim Bryan, Ray Dumas, Dan Govoni, Melody Henkel, Carolyn Maguire, and Lori Kunz devoted a total of 875 hours to this task under the author's direct supervision, for which they were paid minimum wage, in addition to earning internship credit towards their baccalaureate or masters degrees. All of the students performed well under the pressure of time constraints and an overwhelming body of data to catalog. Without their assistance, this phase of the project would not have been possible.

Collectors were contacted by a public meeting held in January of 1991, by several articles in the Middleborough Gazette, the New Bedford Standard-Times, and the Brockton Enterprise, and by personal telephone calls by members of the Middleborough Historical Commission and the Middleborough Natural Resources Preservation Committee. They were asked to bring their collections to the Robbins Museum of Archaeology where the inventorying was taking place, and to identify the specific site locations from which their artifacts came. Sites not previously identified were arbitrarily assigned sequential Middleborough (MBO) site numbers, pending processing into the M.H.C. inventory. If there were no objections, artifacts were labelled with the collector's name and a number. Artifacts were returned to the collectors upon completion of the inventory process. A total of 63 private collections were inventoried in this way.

In addition to private collections, the extensive Middleborough holdings of the Massachusetts Archaeological Society were inventoried, as well as artifacts from the Pratt Farm 1 site in the possession of the Cohannet Chapter of the Massachusetts Archaeological Society, artifacts retained by the Massachusetts Historical Commission from the Soccer Field Site, and artifacts excavated during the course of the cultural resource management surveys mentioned above. Finally, one of the members of the inventory team, Ray Dumas, a Middleborough resident, searched surface locations in many parts of town on his own initiative, and brought artifacts and debitage from these in to the Robbins Museum to be inventoried.

Each artifact was identified as to type and material of manufacture, and measurements of maximum length, width, thickness, and other diagnostic features were taken. All of this information was entered onto a standard record "card" using the Hypercard 2.0 system on a Macintosh SE computer with a 30 megabyte hard drive. In addition, the catalogue number, box or case number, site name and number, U.S.G.S. quadrangle, and more specific provenience information (this applied only to excavated collections) was entered. Each artifact was photographed on a copy stand using Ektachrome 200 slide film. The roll and frame number was also recorded in the computer file. It is the eventual plan of the project to convert the slides into video laserdisk format, keyed to the computer file so as to allow rapid access of visual records. The inventory has the capability of providing accurate measurements of all items as well as visual records, with extensive sorting capabilities. Artifact recoveries are summarized by type in Tables 4-7.

The basis for the model developed from this data base is artifact typology. We know that styles changed over the 9000 years of prehistory that are known to

exist in the town. Also, certain types of artifacts were only used during specific periods, e.g. pottery. If we wish to understand which locations were most likely occupied during which periods, and for what functions, it is important to have this type of inventory data. The computerized inventory allows town planners to view, for example, all those locations with known Early Archaic materials as opposed to Late Woodland. If the former are to be considered more sensitive than the latter because of their uniqueness (a criterion for nomination to the National Register of Historic Places), then this level of information can become an essential planning tool.

The final stage of the project integrates the information from the preceding three stages into a final document which provides the town with a detailed inventory and predictive model for the entire town. Areas are designated in terms of their relative sensitivity for prehistoric cultural materials of each phase of prehistory, and are be assigned functional codes as to site type. This information will enable the town planners to decide whether any specific area of the town merits further archaeological investigation, and will give them the quality information they need to substantiate their decisions. The final product also includes a detailed series of maps, and copies of the computer disks containing the artifact inventory, suitable for the production of programs to call up specific video laserdisk images as required, once the conversion from slide format is made. The slides themselves, along with two copies of the inventory on hard disk, will remain under the curation of the Massachusetts Archaeological Society.

D. Confidentiality:

The Town of Middleborough has recently enacted a by-law which categorically excludes from freedom-of-information requirements information concerning the exact location of archaeological resources. This is an important step which will allow the Town to protect sites more adequately from further looting. The current project design considered controlling the problem of "pot-hunting", as well as protecting the confidentiality of private collectors, to be crucial to its success. Consequently, the following measures are recommended:

1. Individual collectors have been promised an inventory of their collections, as a benefit of voluntary participation in the project. This inventory, which is keyed to the artifact numbers painted on the artifacts or otherwise assigned, will be provided to each collector requesting it -- but only of his or her collection. Artifact recoveries from other collections, even if they are from the same site(s), will not be disclosed. Sites will be identified by name, rather than number, to make it more difficult for collectors to gain access to information about other collections from the report. It is strongly recommended that the Town also keep the data disks containing the complete artifact inventory in a safe place where access will be restricted to those with a genuine need-to-know -- either for scholarly purposes or for environmental management purposes.

2. Specific information concerning site location, including site name, UTM grid coordinates, and names of collectors who have artifacts from each site, as well as the integrity of the site, is restricted to Table One in this report. In all other tables, sites are referred to by their number only, whether by M.H.C. number or MBO number. Sites without M.H.C. numbers are

referred to only by MBO number in the text. Table One should also have restricted access, for which reason it is included separately from the text. It should be noted that M.H.C. has been sent a complete set of archaeological survey forms (Form D) for each site, which also contain all of this information, as well as summary lists of recoveries from each site. For most environmental management purposes, it will be sufficient to send proponents to M.H.C.

3. The map of site locations (Map 2), based upon the U.S.G.S. Quadrangles, should also be kept confidential. The 8 1/2 x 11" maps (Maps 3-12) derived from this are sufficiently vague that they do not require this treatment, nor does the map of sensitivity zones (Map 15). U.S.G.S. maps showing site locations have also been sent to M.H.C.

4. All other information contained in this report is of a general nature and therefore may be made accessible to the public.

V. CONSTRUCTION OF THE MODEL

The following section details the construction of the model of prehistoric site distribution. It describes in detail the six environmental variables (aspect, distance from water, hypsometric integral, stream rank, soil type, and slope) and measures them against five cultural variables, all of which are also described in detail (site age, site function, complexity, redundancy, and intensity). Correlation of the last three cultural variables with the distance of a site to its nearest neighbor was also performed. The resulting tables allow for the construction of hypotheses about the distribution of prehistoric cultural patterns throughout the Town of Middleborough.

A. ENVIRONMENTAL VARIABLES

1. Aspect:

In archaeological terminology, this refers to the general direction in which a site is facing, according to the eight points of the compass. Sites facing the southern quadrant (SE - SW) are sometimes thought to be favored for winter habitation, since they retain sunlight longer and are sheltered from north winds (Fairbanks 1980, Little 1985). Northeast-facing sites in New England are particularly unlikely to be winter locations, given the prevailing direction of severe winter storms. This variable was defined using the U.S.G.S. quadrangle maps to determine the most likely direction of slope from the site, and is presented in nominal form in the tables.

2. Distance from Water:

This is considered to be a critical variable for location of habitation sites, since water is a necessity for both people and the plants and animals they exploit for food. Sites located further than 100 meters from water are considered less likely as habitation sites for this reason (Robertson and Robertson 1978). It should be kept in mind that water levels in Middleborough have changed in complex ways over the past 10,500 years, and that the Nemasket River in particular was subject to violent spring flooding prior to the installation of flood control during the historic period. However, the measure to nearest water (taken from the U.S.G.S. quadrangles) is unlikely to have changed by more than 50 meters for any site listed, and is probably accurate to within 25 meters in most cases. Middleborough is relatively well-watered, and there are very few locations in the town today which are more distant than a kilometer from water. In the tables, distance from water is presented as a range variable. It is given in 25 meter intervals for the first 200 meters, while the data at the upper end of the range of distance (250 - 800 meters) have been grouped for statistical purposes.

3. Hypsometric Integral:

This is a measure of the relative distance upstream any location occupies within its river drainage (Strahler 1957). There is a documented tendency for sites of later periods of prehistory to be further upstream on average, at least from the Late Archaic through the Early Woodland phase (Hoffman 1985). The hypsometric integral curve is calculated by dividing the total area within a drainage which lies under a series of contour lines

by the percent of elevation each of those lines is of the highest elevation in the drainage. This produces a characteristic S-shaped curve which gives the hypsometric integral on the abcissa for relative elevations plotted on the ordinate. As the result of a study done by the author (Hoffman 1985) on drainages in southern New England, a hypsometric integral curve for the Taunton drainage was available for this inventory. Unfortunately, no curves were available for the Sippican, Mattapoisett, or Weweantic drainages, because the original set of curves was calculated using the U.S.G.S. 1:100,000 series of maps, and small coastal drainages like these three do not provide a sufficient number of contours to produce a curve. Consequently, only the sites within the Taunton drainage (all but 27 of the 159 sites used in the inventory) were used for this calculation. The Middleborough/Lakeville ponds were considered part of the Taunton River system because of their connection through the Nemasket River. The range of elevations in the Middleborough portion of the Taunton drainage is between 15 and 191 feet above sea level, corresponding to the 12% and 88% hypsometric integrals, respectively. The data in the tables is presented in intervals of 0.05.

4. Stream Rank:

This is another measure of the degree to which sites are located upstream within drainages (Strahler 1957). Stream rank is calculated by assigning a value of 1 to headwater streams, ponds, and swamps, and adding one number to the rank at each confluence. Thorbahn et al. (1980) suggest that habitation sites in the Taunton drainage will be more likely to be located at sites with high stream rank. For this study, the Taunton River was assigned a rank of 1 at the point of the confluence of the Matfield and

Town Rivers in Bridgewater, rather than tracing it from the network of headwater streams above this point. This may skew the stream ranks of sites on the Taunton River in Middleborough downwards, although it should be noted that they are almost all ranked above 10 even by this method. The data for ranks above 5 is grouped in intervals of 5 ranks in the tables.

5. Soil Type:

Soil type names and descriptions are derived from the U.S.D.A. Soil Survey of Plymouth County (1969). It should be noted that the variability of soil types within the Town of Middleborough is very great, due to differential glacial and post-glacial events (see Barton and Fisher 1974 for a discussion of Middleborough soil types). The northern and southeastern margins of the town are particularly varied, and there are few areas anywhere more distant than a kilometer from soils of a different type. For this reason, the parameter of local soil variability studied in the P.A.L. report (Thorbahn et al 1980) was not considered relevant. Of the 26 soil types described in the U.S.D.A. survey of Plymouth County, only six are absent from the town. Soils are arranged in the table as nominal variables in order of drainage characteristics from wettest to droughtiest, falling into six ranks in the U.S.D.A. system. These range from very poorly drained (Birdsall, Saco, Brockton, Scarborough) to poorly drained (Raynham, Walpole, Au Gres/Wareham, Norwell) to moderately well-drained (Ninigret, Belgrade, Deerfield, Scituate) to well-drained (Agawam, Essex) to well- to somewhat excessively well-drained (Merrimac, Gloucester, Hollis-Charlton) to excessively well-drained (Hinckley, Windsor, Carver). Drainage is an important consideration for habitation sites, since they are

ideally located in areas which are reasonably well-drained, especially for spring locations in river drainages like the Taunton-Nemasket system which are subject to flooding (Robertson and Roberston 1978).

6. Slope:

Slope is derived from the U.S.G.S. Quadrangle maps and reflects the number of contours occupied by the site over its area. Sites with high slope (> 16 degrees) are unlikely to be campsites, for obvious reasons (Robertson and Robertson 1978), but they may have been used for other purposes. Because of its location on the coastal plain, much of Middleborough is fairly flat, with slopes of less than 5 degrees. A significant portion of the town is on moderate slopes of 5 - 15 degrees. A small number of slopes of 15-25 degrees are present. These data are presented in interval form using the three categories above, which are derived from M.H.C.'s Site Inventory forms.

B. CULTURAL VARIABLES

1. Site Age:

Archaeologists use three general techniques to determine the age of sites: radiometric dating, stratigraphy, and stylistic dating. Radiometric (radiocarbon and thermoluminescence) dates are calibrated in years prior to 1950 A.D. (= radiocarbon years before present, or B.P.) with a standard deviation or range of probability. They are currently available for only four sites in Middleborough: Wapanucket 3, 6, 8, (Robbins 1981) and Read Co. (Hoffman 1989a). These provide an incomplete framework for

understanding Middleborough prehistory, especially for the Early and Middle Archaic and Woodland phases. Stratigraphic sequences in southern New England are rare outside of rock shelters, and none of these have been excavated in Middleborough. Therefore, the inventory was forced to rely upon stylistic dating, which is based upon perceived changes in styles in artifact forms over time. These styles are in many cases associated with radiometric dates, which assist in tying down the sequence. However, it must be emphasized that these associations do not limit the distribution of types either before or after the dates in question. It is gradually becoming evident that certain types in southern New England lasted for a long time after their first introduction, for reasons which are still the subject of research (e.g. Filios 1989, Hoffman 1991a). Therefore, the attributions of site age to artifact types which follow below should be taken with a measure of caution. They are largely based upon the traditionally accepted chronology (Johnson and Mahlstedt 1984). In the tables, the presence of diagnostics of one or more phases at a site is taken to indicate the presence of at least one occupation of that phase. The phases are presented as nominal variables across the top of the table. Where no diagnostic artifacts were present, the age is listed as unknown (UN).

a. Paleo-Indian (PI) (10,500 - 9,000 B.P.)

Paleo-Indians were the first human occupants of New England, arriving during the period of pine forest succession following the northward retreat of the glacial ice fronts and the adjacent spruce parklands and tundras. They appear to have been wide-ranging foragers, perhaps moving over the entirety of New England in the course of a yearly round (Curran and Grimes 1989). Paleo-Indian sites are quite rare in the region, suggesting that

populations were small as well as highly mobile. Identification of Paleo-Indian occupations is considered to be a highly important research priority by regional archaeologists for this reason, as well as for the glimpses into Early Holocene small-scale foraging economies which these sites provide. Any confirmed Paleo-Indian site is therefore likely to be of sufficient significance for nomination to the National Register of Historic Places. The presence of Paleo-Indians at Middleborough sites was identified by the identification of characteristic Clovis (fluted), Eden (Parallel Lanceolate), Parallel Stemmed, Greenbriar, and Hardaway-Dalton projectile points. Other tools include flake shavers (limaces), gravers, wedges (pieces esquillees), and unifacial steepedge scrapers. All of these tools are characteristic of Paleo-Indian assemblages, although all of them can and do occur in later assemblages.

b. <u>Early Archaic</u> (EA) (9,000 - 8,000 B.P.)

The Early Archaic saw the height of temperature recovery from the last glacial episode (the hypsithermal). Forest cover would have been dominated by an oak-pine-hemlock mix. Foraging groups of this phase may have been adapted to major inland riverine routes due to rapid sea level rise on the coast. Dincauze (1989) refers to these people as "pioneers" and considers that they may have been the first to explore much of the New England region in detail. Early Archaic sites are rather rare throughout the New England region, but Hallaren (1988) has hypothesized that the Weymouth Fore and Back, North, and Taunton River systems provided an inland waterway from the Boston Basin to Narragansett Bay which was greatly favored by these peoples. The importance of the Taunton River as a center for Early Archaic tool manufacture has been recognized for some time (Taylor 1976, Snow 1980,

Hallaren 1988). Since it occupies a key point within this Taunton River complex, Middleborough's Early Archaic sites are likely to be of great significance for archaeological research into the lifeways of this period. Characteristic projectile points include Kirk Stemmed and Corner-Notched varieties, and most especially Bifurcate Base points. The latter have been securely dated at the Plymouth Street site at the Matfield-Town River confluence in Bridgewater at 7920±200 B.P. (Hallaren 1988). Other tools include bow-tie atl-atl weights, unifacial steepedge scrapers, and wedges, but again these are not necessarily good diagnostics of this period alone.

c. Middle Archaic (MA) (8,000 - 6,000 B.P.)

Middle Archaic adaptations also span the hypsithermal interval and the oak-pine-hemlock forest regimen. They were strongly oriented toward riverine resources, especially anadromous fish (Dincauze 1976). While most studies of Middle Archaic anadromous fishing in New England have concentrated on the Merrimack, Neponset, and Charles River drainages (e.g. Dincauze 1974, 1976; Nelson and Hoffman 1983; Luedtke 1985), it is likely that this activity was also important in Middleborough, along the middle reaches of the Taunton drainage, and on the Nemasket River as well. The stemmed point complexes of this phase (Neville, Neville Variant, Stark, and Merrimack) appear to have developed out of an earlier Kirk horizon. These point types are the first to be found commonly throughout southern New England. It may be the case that populations had by this time become familiar enough with the most productive resources of the region that they were able for the first time to thrive and grow. Alternatively (and these hypotheses are not mutually exclusive), Neville and Stark points may be

more common for the reason that their forms were retained over a long period of time whereas those of the Paleo-Indian and Early Archaic phases were not. Neville and Stark points have been found in reliable associations with radiocarbon dates as late as the Early Woodland period in many sites in southern New England (Hoffman 1991c), and the later associations include one Middleborough site. Research into this and other typological problems will doubtless continue to generate interest among the archaological community, but for the purposes of this inventory the points in question were counted as Middle Archaic. Other tools counted within this phase include oval atl-atl weights, hole stones, U-based knives (actually Neville preforms), and Neville and Stark style drills.

d. Late Archaic (LA) (6,000 - 4,000 B.P.)

By Late Archaic times, the climate had begun to moderate toward modern conditions, and the rate of sea level rise had levelled off somewhat. The modern configuration of the coast had been achieved, with Martha's Vineyard and Nantucket separated from the mainland. The Late Archaic saw the emergence of hickory trees as an important food resource, and the disappearance (around 4700 B.P.) of hemlock. It was a time of great resource diversity and abundance, and human populations appear to have increased in response to this, diversifying into a variety of environments. Two specific traditions are usually recognized from this phase, although their relationship to one another is a matter of doubt. The Laurentian tradition, best documented in New York, Ontario, and central southern New England (Funk 1988, Hoffman 1990) is characterized by the use of side-notched and eared points of the Otter Creek-Brewerton-Vosburg series,

as well as winged atl-atl weights, gouges, grooved axes, semi-lunar knives, and classic plummets. It undoubtedly began earlier than the Small Stemmed (or Piedmont, Coastal, or Atlantic Slope) Tradition, which was more intensely focused on the coastal zone and is characterized by the use of Small Stemmed and Small Triangular (Beekman, Squibnocket) points (Dincauze 1975). However, there was clearly some interaction between the two traditions, as triangular points are common to both of them and may derive ultimately from the lanceolate points of the Paleo-Indian phase, while the stemmed points probably evolved out of the Middle Archaic stemmed point sequence. In fact, both sets of styles are fairly common throughout Southern New England, both in coastal and interior locations. Use of Small stemmed points has also been demonstrated to endure far beyond the end of this period in southern New England (e.g. Thorbahn 1984, Filios 1989). Nevertheless, the overwhelming numbers of Small Stemmed and Small Triangular points in the coastal plain of southern New England has suggested that this phase saw a marked population increase, or at least an increase in population dispersion to more and more upstream locations (Hoffman 1985).

e. Transitional Archaic (TA) (4,000 - 3,000 B.P.)

The Transitional Archaic term is not universally accepted; Snow (1980) uses "Terminal Archaic" while Dincauze (1975) includes this phase within the Late Archaic. It saw an intensification of ceremonial activities, especially associated with a burial cult. Characteristic point styles include stemmed (Atlantic, Susquehanna Broad, Genessee) and notched (Wayland Notched, Normanskill) varieties, and these were sometimes made in extra large sizes and of exotic materials for placement in cremation burials. Full-grooved axes, whaletail atl-atl weights, clumsy plummets,

and steatite bowls are also diagnostic of this phase. It may represent an attempt to establish central political elites within tribes living in favored areas, as well as the beginnings of intensive seed-collecting (Pagoulatos 1988). This may have been in response to population pressures and/or environmental shifts in the coastal zone. A marked emphasis on smaller territory sizes has also been suggested, implying greater solidarity and nucleation of social groups. Thorbahn (1982) suggested that this may have been the result of an environmental shift, based upon evidence from the pollen cores at Nippenicket and Nunket's Ponds. However, the pollen core from Pocksha Marsh showed no evidence of desiccation, nor do others in the region. It is now acknowledged (Simon 1991) that the desiccation episode at Nippenicket and Nunket's Ponds was most likely a localized event affecting settlement patterns in only a very limited area. The shift to smaller territory size and greater centralization of authority must be explained by other factors. Developments of this sort in some parts of the world were precursors to settled village life and horticulture. However, this did not happen for another 2000 years in New England prehistory, and it is important to discover the reasons why it did not. Interior areas saw little of these developments. It is possible that the beginnings of social inequality, with developed regional cores and exploited peripheries, are present in this phase, in which case riverine areas such as Middleborough are likely to provide key information on cores as well as their relationship to <u>local</u> peripheries (the uplands adjacent to the river basins).

f. <u>Early Woodland</u> (EW) (3,000 - 2,000 B.P.)

The Early Woodland used to be thought of as the period of the inception of pottery in New England; but there are now some Transitional

Archaic dates for the earliest (Vinette I) pottery styles (Thorbahn 1982). The majority of settlements were on the coast, and the interior may have been largely abandoned. Sea level stabilized during this phase, leading to the development of stable shellfish beds in tidal waters (Kerber 1985). The ceremonialism of the preceding phase was influenced by developments further to the west (Adena), although burials of this phase are considerably less commonly found, except in some of the major river valleys. Middleborough may have remained part of the ceremonial complex, in which case research could be very revealing as to the causes of the collapse of the Transitional Archaic complexes. Characteristic points include Adena and Meadowood styles (often executed in exotic materials), as well as more localized types such as Orient Fishtail, Rossville, and Lagoon. Clay and stone tubular pipes, as well as a limited number of rolled copper beads, also characterize burials of this phase.

g. Middle Woodland (MW) (2,000 - 1,000 B.P.)

This phase saw the intensification of long-distance trade for exotic lithics, especially cherts from New York and Pennsylvania. By the conclusion of the phase, initial experiments in horticulture had begun, but the imported cultigens (corn, beans and squashes) did not form any substantial portion of the diet. Diagnostic projectiles include Greene, Fox Creek Lanceolate and Stemmed points, and Jack's Reef Pentagonal and Corner-Notched varieties. Notched weights and tapered-stem drills may also derive from this phase, as do a variety of incised pottery styles. Most pots were tempered with grit and were fairly thick-walled, but not as much as their Early Woodland predecessors. Regional variations in pottery designs may reflect stable matrilocal village patterns (Kenyon 1986).

Because of its key location on interior trade routes, Middleborough may have been an important center for distribution of exotic materials during this phase.

h. Late Woodland (LW) (1,000 - 350 B.P.)

The Late Woodland saw the introduction of horticultural products as important sources of food for the first time. Hunting methods were augmented by the introduction of the bow and arrow. This may have made older styles of projectile points obsolete; in any event triangular Levanna and Madison points predominated. Trade for exotic lithics was not as intense as in the preceding period. Pottery is often better made, more elaborately decorated, and tempered with shell. There may have been some intensification of ceremonialism, reflected in mass ossuaries (McManamon and Bradley 1986) and intentional arrangements of stone cairns (Mavor and Dix 1989). Some evidence for inter-tribal warfare is alleged for this phase, although it may in fact not have been an important function prior to European contact (Feder 1984). Settled villages and the use of wampum shell for ornamentation and display of status were also late developments. The interior trade networks by overland trail and dugout canoe were well established by this time, and lasted well into the succeeding Contact period; several such trails are documented running through Middleborough (Robbins 1984a, b, c, and d)

i. Contact (CO) (350 - 200 B.P.; 1600 - 1750 A.D.)

Europeans began intensive fishing and exploration off the New England coast by the early 1500's, and several 16th and early 17th century accounts mention contact and barter with Native Americans. By the time of the first settlement at Plymouth in 1620 the Indians were familiar with English trade

goods such as sheet metal and beads, and were also aware of the English desire for beaver pelts. The relationship between the two groups deteriorated over the next two centuries as English settlers claimed more and more lands for grazing and agriculture and the Indians were forced further west and marginalized (Cronon 1983, Axtell 1981). Several pre-existing paths leading through Middleborough were utilized by Plymouth Colony residents as a means of penetrating into the interior and establishing settlements. These include the Upper (Chestnut and Purchase Sts.) and Lower (Plymouth St.) Plimoth Paths (Robbins 1984a), and the Cohannet or Taunton Path (Robbins 1984b). King Philip's War (1675-76) was the only really organized resistance to European encroachment, and it failed largely because of the ability of the English to exploit intertribal differences. Both before and after the war, significant portions of the Town of Middleborough were deeded to the English by the Indians, who apparently tried to retain certain traditional lands for themselves as long as possible (Hoffman 1989a). Betty's Neck in Lakeville survived as a Native American settlement and burial ground into the early decades of the Twentieth Century, and Native Americans continue to reside in the Middleborough area, and retain considerable pride in their heritage. Characteristic artifacts of the Contact phase include metal cut-out projectile points and gunflints, especially those made of ballast flint imported (sometimes unintentionally) from the Old World. Other metal items are occasionally found in non-European contexts.

2. Site Function:

One of the ways in which sites can be evaluated is in terms of their function: that is, what types of activities were taking place at the site. Sites can either be specialized (only one activity documented) or

generalized (many activities taking place). Some of the same caveats listed above for site age should be taken into consideration in assigning site functions on the basis of artifact types. In this case, the functions of tools were more important than their style, but function was inferred largely from shape and size. No use-wear studies were done for this inventory, so it is possible that some tools described as scrapers may actually be knives, and vice versa (e.g. Roberts 1980). Also, the presence of a tool at a site does not necessarily mean that the activity it implies was taking place at the site; it may have simply been manufactured or lost there. The tables are not quantitative; they do not indicate how many artifacts were present which imply each activity. The activities are presented as nominal variables across the top of the table. No attempt has been made to link features at excavated sites with these functions.

a. Ceremonialism (CE)

This activity is inferred to be present when much larger than normal, well-made projectile points are found in an assemblage. Most of these appear to date to the Transitional Archaic or Early Woodland phases. Other tools that imply ceremonialism are pendants, gorgets, petroglyphs, paintstones, stone counters, smoking pipes, large chipped slabs, or "magic" stones -- pebbles of unusual material, or quartz crystals (Fowler 1975). Human burials are also important evidence of ceremonial activity. While none was inventoried during this project, records of several burials from Middleborough are on file at M.H.C., and some publications of burial contents and structure have been made (Dodge 1953, Fowler 1974, 1982, Robbins 1958, 1981, Taylor 1982). Another important type of ceremonial

artifact found in Middleborough is rock carving. Several examples of this are known from sites on the bluffs overlooking the Nemasket River, as well as at more distant locations, but all were on glacial erratic boulders far too large to be moved to the inventorying station, and they have not been included in the inventory as individual artifacts for this reason. At least two of these sites (Hand Rock and Sacred Rock) produced movable ceremonial items as well. All of this evidence is important to an understanding of the religious and thought life of the native inhabitants of Middleborough, as well as providing documentation on social practices and status.

b. Clothes/Hide Processing (CP)

Native American clothing was principally fashioned from animal hides, especially those of white-tailed deer. The process of hide preparation through brain-tanning has been well described by McPherson (1986). Stone scrapers were the principal tool used to prepare skins for clothing, but some may have doubled as hide scrapers and meat processors. Therefore, they were not used as determinants for this function. Drills, which were presumably used as punches for perforating clothing so that it could be tied together with thongs, were the major diagnostic of this function. Bone awls were also included.

c. Fishing (FI)

Fishing was an important source of food for Native American populations in New England, both for fresh-water and anadromous fish. Fish were taken in large numbers using weirs and gill nets, as well as individual lines with hooks. Spear fishing with leisters (multiple-pronged spears) or single spears is also attested. The presence of this activity

was implied from the presence of plummets, grooved weights, or notched weights. Certain isolated projectiles in shoreline locations also were identified as relating to this activity.

d. <u>Food Processing</u> (FP)

Native Americans from at least Early Archaic times onward consumed a varied diet of wild animal foods (deer, turkey, beaver, rabbit, birds, snakes, turtles, and a wide variety of small mammals). Biface edge tools (knives and scrapers, but particularly knives) were the major diagnostic for this function. Little of the edible meat was wasted; bone was split to extract marrow using wedges. Gathered foods (seeds, nuts, large root vegetables, and later horticultural products) were processed using pestles, mullers, mortars, nutting stones, and pounders. These foods formed a very important part of the diet, especially since they are more storable than meats and can provide sustenance through the winter months if one has storage technology.

e. <u>Food Storage</u> (FS)

This function was inferred from the presence of containers -- either of steatite or pottery (or, in one case, of wood). Admittedly these could have also been used for cooking, a food processing activity. Features at excavated sites which might have been used as storage pits were not counted, since there is usually no conclusive evidence that they were dug for this purpose, rather than waste disposal. Storage became an increasingly important issue as foraging groups made the transition to collecting strategies starting in the Transitional Archaic (Pagoulatos 1988).

f. Horticulture (HO)

The above storage and vegetable-processing technologies were not necessarily restricted to horticultural products, although they were a necessary preadaptation to the practice of horticulture. Actual horticulture is, as indicated above, rather late in the New England prehistoric sequence. Diagnostics are limited to hoes and spades, although these could also have been used for other purposes, such as digging for large edible roots.

g. Hunting (HU)

Hunting was inferred when projectile points were present. Perhaps surprisingly, this included less than half of the sites in the inventory. Projectiles could also be evidence of inter- or intra-tribal trade and warfare, or they could be ceremonial goods. Atl-atl weights are also prima facie evidence of hunting activity.

h. Tool-Making (TM)

Native Americans made tools of many natural materials in their environment. However, New England's acidic soils rapidly destroy organic materials, often leaving behind only the remnants of stone tool-making. This function was inferred when the debris of tool making was present: broken bifaces, cores, and preforms. Hammerstones, anvils, and quarry disks also indicate stone tool-making activities. In general, sites at which flakes were recovered were not included, unless flakes were the only type of recovery from the site.

i. Trade (TR)

Barber (1982) has produced a model for prehistoric exchange of lithic materials in southern New England based upon the distance one could walk, round trip, from one's campsite in a day or a week. Materials within the first category are considered strictly local; those within the second are regional and might be acquired through either trade or direct procurement; while those outside of the outer circle are considered to be exotic and to derive from trading activities. This model works well for certain periods of prehistory, but not for the Paleo-Indian phase (and perhaps not for the Early Archaic either), due to the higher mobility of early band societies. Bedrock in the Middleborough area is mostly arkose (Zen et al. 1982) and coalstone, and the Rhode Island argillite sources are probably within the margin of the local/regional boundary, but the glacier has also deposited considerable quantities of fine-grained felsite, quartz, quartzite, hornfels, and argillite throughout the town. This blurs the picture for many of these materials. Consequently, only exotic materials derived from far to the east or west of Middleborough were used. These included cherts, chalcedonies, agates, and jaspers from New York, Pennsylvania, Ohio, and even further west, ballast flints and metal objects from the Old World, and steatite from central southern New England. The presence of exotic materials at a site does not necessarily allow the inference that trade took place at the site, but only that the materials reached the site as a result of trade at some point.

j. Woodworking (WW)

As noted above, wood does not normally preserve well in acidic New England soils, but its presence in assemblages can be inferred from a specific suite of tools whose function is related to the woodworking industry. These include axes, adzes, gouges, celts, hatchets, roughing knives, notchers, and shaft abraders.

3. Complexity:

Sites at which only one of the above activities was being performed are referred to as special-purpose or single-function sites. Sites with more than one activity pattern are more complex. A few sites will have all or most of the activities represented. It should be emphasized that these are for the most part locations that have been subjected to intensive subsurface investigation, and that some of the sites which on the basis of surface recoveries seem to be special-purpose camps may upon excavation turn out to be more complex. Thus, the information in the tables should be considered to represent the minimum complexity of the site. No attempt has been made to separate out activities by time period, for the reason that, as questionable as the chronology for projectile points may be, that for all other tool types is much less reliable. Complexity is expressed at the top of the tables in terms of the number of functions represented.

4. Redundancy:

Sites which were occupied only once throughout prehistory are referred to as single-component sites. Those with two or more recognizable occupations are called multi-component sites. A few sites appear to have

been occupied for all or most of the span of New England prehistory. As is the case with complexity, many of these redundantly occupied locations are excavated sites from which a large (and presumably more representative) assemblage has been recovered. Sites known from only surface materials may very well contain evidence of more components than the surface materials indicate. The identification of components is derived from the site age variable, and is expressed at the top of the tables in terms of the minimum number of components represented. Sites of unknown age have been omitted from this table.

5. Intensity:

This variable provides a rough first-order approximation of the amount of activity taking place at any one time at a site, which may be an indicator of population size. It is derived by dividing the total number of artifacts retrieved from the site by the number of recognized age components and rounding to the nearest whole number. Sites of unknown age were omitted from this calculation. Once again, the intensity of archaeological activity on excavated sites will have skewed this figure upwards. The number is expressed in the form of range data across the top of the tables, adjusted for statistical purposes.

6. Clustering:

In order to further test the relationships of complexity, redundancy, and intensity, they were correlated with the sites in terms of the closest distance between any site and its nearest known neighbor. This was calculated from the U.S.G.S. Quadrangles with compass and straightedge to the nearest 25 meters, measuring between the presumed site centers.

Obviously, this correlation presumes that there are no additional sites which might be closer than those in the inventory. Thus, it should be considered as a maximal distance. The distance to nearest neighbor is presented in the tables as range data, with some combination at the upper end of the range for statistical purposes. The three variables against which it is measured are presented as in the other tables as interval or range data across the top of the tables. This correlation gives a quantitative measure of the degree of site clustering.

A second measure of clustering is provided by Map 11, which illustrates the number of sites per square kilometer in Middleborough, based upon the UTM grid on the U.S.G.S. contour maps. Like the nearest neighbor analysis, this depends upon the distribution of known sites. Sites which overlapped into two 1 km. quadrats were counted twice. Several sites listed in M.H.C. files which did not produce artifacts for the inventory were included in this map. Clusters are defined, arbitrarily, as locations where the total number of sites in any two adjacent square kilometers is greater than five.

VI. RESULTS OF APPLICATION OF THE MODEL

A. Site Age (See Tables 8-13)

1. Paleo-Indian (See Map 4):

Sites attributed to this age are the fewest in number, 6. None of them faced in an east, northeast, or northerly direction, but the distribution for other directions was about equal. Given Curran and Grimes' (1989) suggestion that southern New England Paleo-Indian sites may have been preferred winter locations, the presence of 3 sites in the northwest and westerly directions is surprising. Either Curran and Grimes' hypothesis does not apply to Middleborough sites (they were mostly discussing recoveries at Bull Brook, Dedic, and Whipple), or the hypothesis that winter sites need to be located in southerly aspect is inaccurate, or -- and the author favors this hypothesis -- by the time of the Late Paleo-Indian occupation of Middleborough, dated at 9000±270 B.P. at Wapanucket 8 by thermoluminescence (Robbins 1981:290; no sample number given but the sample was run at the Center for Archaeometry, Washington University, St. Louis, Missouri), the hypsithermal had already begun and winters were less severe than during most other periods of prehistory. The hypsithermal is clearly marked in the pollen core by changes in both vegetation and preservation of pollen grains, and it appears to have peaked around 7000 B.P. (radiocarbon dates are not yet available), but it may have begun considerably earlier.

The 6 sites are all located within 150 meters of modern water resources. The Wapanucket Beach site is actually on the modern shore line, although it is probable that the material at that location has eroded out of the bluff to the north during winter storms (Robbins 1981). Robbins has also

hypothesized that the level of Assawompsett Pond was lower during Paleo-Indian times, since tree stump fragments have been found about 7 meters offshore. A raising of lake levels during the late 17th century is documented. The greater proximity to water may also suggest occupation during the early hypsithermal.

Hypsometric integrals vary between 16 and 55%, with 3 of the sites (50%) between 44 and 55%. This suggests a preferred usage of middle ranges of drainages. All but one of the sites are closest to rank 1 - 4 streams, which is not surprising given the preference for Paleo-Indian sites to be located with respect to migration routes of herd animals. Both of these parameters suggest that an orientation to <u>major</u> water resources had not yet been established by Late Paleo-Indian times, even though proximity to water, as noted above, was an important consideration.

All six Paleo-Indian sites are located on well- to excessively well-drained soils. This preference is stronger than for any other phase of prehistory. All but one of the sites are located on low (0-5 degree) slopes, the exception being on a 5-15 degree slope. This is again a stronger preference than is found for sites of other phases.

In conclusion, Paleo-Indian sites in Middleborough have a high degree of selectivity. They are most likely to be found in southeast to northwest-facing locations, within 150 meters of water, in the middle ranges of the Taunton and Nemasket drainages (none are so far documented for the other drainages), on fairly low-ranked streams, in flat areas with well-drained soils. Exotic materials were fairly common (21 items). It might be noted that all six Paleo-Indian sites were occupied repeatedly throughout prehistory; the lowest redundancy figure for any of them is 5 components.

MAP 4
Paleo-Indian & Early Archaic Sites

x = Paleo-Indian
+ = Early Archaic
* = Both Phases

2. <u>Early Archaic</u> (See Map 4):

A total of 14 Early Archaic locations are documented, a very high figure for southern New England. None of these is oriented to either the east or the northeast, and there is a strong preference for locations in the southern quadrant (9 out of 14, or 64%). Hallaren (1988) had documented the importance of south-facing cove sites for Early Archaic occupations in the upper Taunton and North River drainages, and the Middleborough sites tend to follow this pattern.

As with the Paleo-Indian sites, Early Archaic sites tend to be located moderately close to water. The maximum distance is 175 meters, represented by only one location. Seven sites (50%) are within 50 meters of water, a much stronger correlation than for the Paleo-Indian phase. This suggests that by Early Archaic times the hypsithermal interval was in full force, making proximity to water more critical for human habitation.

Hypsometric integrals vary between 16 and 44%, with a strong cluster of 6 sites at 44%. This continues the mid-drainage tendency of the Paleo-Indian phase. Stream ranks are very variable, however, ranging from 1 to 20, with clusters of 6 at rank 2 and 3 at ranks 16-20. This suggests a diversification of occupational niches, with some sites (e.g. Fort Hill, Taylor Farm) being located close to major rivers, while others (e.g. MBO 76) being near springs at headwaters.

Most sites are located on well- to excessively-well drained soils, with a strong cluster of 9 (64%) in Windsor sandy loams. However, two sites occur in poorly drained loamy sands or silt loams, both of them close to water. This suggests that proximity to water may have been more important than

drainage. If the hypsithermal was a dryer period, the occupation of poorly drained sites may not have been as great a drawback as in Paleo-Indian times.

Most sites (64%) are located on low slopes, but a fairly large number (36%) are on moderate (5-15 degree) slopes. These are once again locations close to water resources, including some headwater campsites.

In conclusion, Early Archaic locations are somewhat more selective for aspect than Paleo-Indian sites, having a strong southern quadrant preference. They are similarly close to water and occupy similar mid-drainage ranges in the Taunton drainage (again, none are documented from outside this drainage), but are somwehat less selective with regard to stream rank and soil type and significantly less selective with regard to slope. Lower stream ranks and slopes and well-drained soils were still preferred. Exotic materials were rather uncommon (2 items), suggesting greater reliance on local lithics. All 14 sites were reoccupied repeatedly throughout prehistory, the lowest redundancy figure being 4 components. This may also represent adaptations to the severe climates of the intensifying hypsithermal, when water was becoming more scarce (Hallaren 1988).

3. <u>Middle Archaic</u> (see Map 5):

Middle Archaic components are more than twice as numerous as Early Archaic (30 sites). It may be debated whether this represents population increase, population dispersion, or simply the continued use of presumed Middle Archaic diagnostics during later periods of prehistory (Hoffman 1986). However, it may be noted that the dispersion of sites is greater at this time, possibly in response to the the peak hypsithermal conditions noted in the pollen core. Only northeast aspects are not documented, although there is only one

east-facing site. Preferences among the remaining directions do not appear to favor strongly any one orientation, although west and southwest-facing sites are less common (3 each, or 10%).

Distance to water is much more variable than in the previous two phases. It ranges between 10 and 400 meters, with nearly half (14, or 47%) being between 50 and 75 meters. Only 3 sites were more distant than 200 meters from water. However, this distribution represents the beginnings of a trend toward increasing diversity of site locations with respect to water resources. This is surprising, given that the hypsithermal interval continued well into this phase. Once again, a possible explanation may be that the Neville and Stark points used to identify this phase may in fact be holdovers from later phases. For example, a radiocarbon date of 4290±140 B.P. (GX-1104) from Feature 206 at Wapanucket 8 was closely associated with a Stark point (Robbins 1981:316), along with Small Stemmed and Squibnocket Triangular points, plain gouges, and sharpening stones. Robbins goes to some lengths to argue for the deeper deposition of Nevilles and Starks at Wapanucket 2 and 6, but he admits that at Wapanucket 8, where they are most common, they are "hopelessly intermixed" with points of later styles (Robbins 1981:312).

Hypsometric integrals are also widely dispersed, between 14 and 58%. Of the 28 sites located in the Taunton drainage, 14 (50%) are between 36 and 45%, similar to the strong mid-drainage clusters for the preceding phases. However, there is a cluster of 5 sites (18%) between 15 and 20%, most of these being on the Taunton River. Stream ranks are similarly dispersed, as in the Early Archaic, but there is a stronger preference for rank 1-2 sites (14, or 47%). This supports the hypothesis above concerning greater distribution of Middle Archaic sites with respect to water resources.

Soil types are still strongly oriented toward well- to excessively well-drained soils (25 sites, or 83%, with a strong showing of 40% in Windsor soils), but there is still a scatter of sites (17%) in locations with poor to moderate drainage characteristics. Slopes are distributed similarly to Early Archaic occupations, with 67% being at 0-5 degrees and 33% at 5-15 degrees.

In conclusion, Middle Archaic sites in Middleborough show increasing diversity of location in terms of aspect, distance to water, hypsometric integral, and stream rank, although preferences for south-facing sites at mid-drainage, moderately close to water continued. They are slightly more selective of well-drained soils than Early Archaic sites, and have similar slope choices. Exotic materials were less common, proportional to the total of diagnostics, than for the preceding phases (2 items). For the first time, occupation occurs in the minor drainages in the southeastern portions of the town. While no single-component locations are known, there are 4 sites which were only occupied during this phase and the subsequent Late Archaic.

4. Late Archaic (see Map 5):

Late Archaic sites are more numerous than sites of any other phase of prehistory (54, or 17%). As with the Middle Archaic, this figure may be artifically inflated, since some of the more popular types (especially Small Stemmed and Squibnocket Triangles) continued well beyond the end of the period (McBride and Dewar 1981, Hoffman 1985, Kerber 1985, Filios 1989). However, 5 of the 14 radiometric dates from Middleborough derive from this period, from Wapanucket 3, 6, and 8. The Fort Hill area also has two radiocarbon dates from this phase, from the Titicut site on the Bridgewater side of the Taunton River (Robbins 1967). Laurentian diagnostics are not very common at Middleborough

MAP 5
Middle and Late Archaic Sites
x = Middle Archaic
+ = Late Archaic
* = Both Phases

sites (103 projectiles, or 5% of all projectiles), and they occur at only two sites (MBO 90 and 99) in the absence of Small Stemmed points, so they will be included in the following discussion of site distributions. Exotic materials were less common, proportional to the total of diagnostics, than for any other period of prehistory (4 items), and most were Laurentian points.

Sites of this phase are found in all orientations, but there is a strong preference for south-facing aspects (30%) -- the strongest southern preference of any phase except the Early Archaic. In all, 54% of sites (29) faced the southern quadrant. East-facing and northeast-facing were the least common (4 and 2%, respectively). Dincauze (1975) has theorized that the Late Archaic represents a time of decreased territorial ranges for groups, which may mean that it was necessary to locate camps of all seasons within a narrower range. South-facing Middle Archaic sites previously located at greater distances from warm-weather camps might now have had to be concetrated in a smaller area. Dincauze has also hypothesized (1975) that the Wapanucket site was a winter camp, on the basis of the orientation of the house entrances with respect to winds coming off the pond.

Distance from water is similar in its diversity to the Middle Archaic phase. The largest cluster is between 30 and 75 meters from water (37%). There is a second cluster between 105 and 150 meters (22%). Seven sites were more distant than 200 meters (13%), only slightly more than in the Middle Archaic.

Hypsometric integrals are also very diverse, ranging from 14 to 61%. There are two clusters: one at 15-20% (10 sites, or 19%), the other at 41-45% (14 sites, or 26%). These correspond in part to two major clusters of sites in town, on the northern shore of Assawompsett Pond and around Fort Hill. Stream ranks also reflect these two clusters: 16 sites (30%) at rank 2 (which includes

the ponds), and 7 sites (13%) at ranks 16-20 (which includes the Fort Hill complex). However, there is also a strong cluster of 14 sites (26%) on rank 1 streams, more than in preceding periods. This percentage is closely matched for Transitional Archaic and Late Woodland components.

Late Archaic sites were found in all soil types except Scituate and Deerfield, but there was still a strong tendency for them to be in well- to excessively well-drained soils (83%), with 37% in Windsor sandy loam. These preferences are essentially the same as for Middle Archaic sites. The distribution of slopes is also similar to the Middle Archaic, with 63% on 0-5 degree slopes and 33% on 5-15 degree slopes. For the first time, a few sites are located on more extreme slopes (4%).

In conclusion, Late Archaic sites are common and widely distributed throughout the town. They continue to show preferences for south-facing locations, short to moderate distances from water, low to moderate hypsometric integrals, well-drained soils, and shallow slopes, but stream ranks indicate a differentiation between headwater camps and major riverine locations. Single component sites occur for the first time during this phase, 13 of them in all (24%), and there are 10 additional locations (19%) which have diagnostics of only one period other than the Late Archaic. This suggests a dispersed settlement pattern which accords well with our knowledge of this phase elsewhere in New England (e.g. Thorbahn 1982, 1984, Hoffman 1985).

5. <u>Transitional Archaic</u> (see Map 6):

A total of 35 components are known from this phase in Middleborough. They include the Wapanucket 8 site, with 6 radiocarbon dates for its well-defined circular village patterns and central ceremonial huts. Ceremonial

MAP 6
Transitional Archaic Sites

activities are of great importance for this phase, and are documented at 12 sites (34%), including 4 single-component sites. Exotic materials are more common than for any other phase (63 items), and much of the imported chert was used to manufacture ceremonial blades. This suggests that trade was an important function of this phase, at least in relation to its ceremonial activities.

Distribution by aspect is somewhat more diffuse than for the Late Archaic, with more sites in the northwest (23%) than in the south (20%), the only phase other than Paleo-Indian in which this is the case. If, as Bradshaw, Nelson, and McGown (1982) suggest, the 4th radiocarbon millenium in southeastern Massachusetts experienced desiccation and rapid peat formation, perhaps this could explain the diminished need for south-facing winter camps. However, if this was merely a localized event in Bridgewater/Raynham, as suggested by the Pocksha Marsh pollen core, then another explanation for the dispered aspects of this phase must be found. Perhaps the creation of local cores and peripheries, as suggested in the preceding section, might have had the effect of freeing special task locations from dependence on south-quadrant sites.

Distance from water is more widely dispersed than for any other period of prehistory, with one location (MBO 78) fully 850 meters from nearest water (the drainage patterns in this area may have been transformed by the construction of I-495, however). The emphasis on sites between 30 and 75 meters from water we have observed during previous phases is still present, but slightly diminished (34%), and the second Late Archaic mode around 150 meters has disappeared. Fully 17% of the sites are further than 200 meters from water, more than for any period other than Late Woodland. This continues the dispersal pattern noted in the Late Archaic, and contradicts the suggestion of Bradshaw et

al. (1982) that the climate was hot and dry: if it were, the sites should cluster closer to water resources, as in the Early Archaic.

Hypsometric integral distributions are very similar to those in the Late Archaic, with two modes at 15-20% (20%) and 41-45% (20%). One site, MBO 117, is located at 77%, the furthest upstream datable site in the town. Stream ranks also are similar to Late Archaic patterns, with 9 at rank 1 (26%), 7 at rank 2 (20%), and 6 at ranks 16-20 (17%). This also suggests a dispersed settlement pattern with some locations at headwater streams and ponds, while others were along the major rivers. This includes the Indian Hill area for the first time as an important cluster.

Soil types chosen were, as usual, mostly well-drained to excessively well-drained (80%), with 28% in Windsor soils. However, slopes show a very different distribution from preceding periods, which will carry over into some of the Woodland phases: sites on shallow slopes are only slightly more common than those on moderate slopes 51 and 47%, respectively). One site (MBO 91) was located on a steeper slope (2%).

In conclusion, Transitional Archaic sites are somewhat more difficult to characterize than those of other phases, in that site selection parameters were slightly less strongly influenced by environmental considerations. South- or northwest-facing locations moderately close to water with low to moderate hypsometric integrals, good drainage, and low to moderate slopes were still preferred, but not as clearly as before. The frequency of single component loci is not quite as strong as in the Late Archaic (17%), but it is much higher than for subsequent phases. This fits with an observed pattern for wider dispersal of sites during this and the preceding phase which Thorbahn (1982) attributes to environmental stress leading to formation of base camps and task-specific

satellite locations and the present author (1985) attributes to population pressures and the attempt to retain political autonomy (see also Kences 1990 for a description of this in relation to Transitional Archaic ceremonialism). The author's perspective is corroborated by the pollen core, which shows no evidence of a desiccation phase at this level. It is becoming evident that the desiccation reported by Bradshaw et al. (1982) from Nippenicket and Nunket's Ponds in Bridgewater was a strictly local event (Simon 1991), unparalleled in either Middleborough or in the Black Pond core taken by Sneddon in Norwell (1987).

6. Early Woodland (see Map 7):

Sites of this phase are slightly more common than for Transitional Archaic (36), the second highest number of sites per phase. This is surprising, since most commentators have presupposed a decline in the number of sites for this phase , or at least a retreat to coastal locations (e.g. Dincauze 1974). Middleborough is not a coastal location, though it has access to the coastal plain. A significant number of diagnostic artifacts were of exotic lithics (17), mostly Meadowoods and Orient Fishtails. These suggest the continued importance of trade during this phase.

Aspects resemble the patterns for the Late Archaic, with a major mode in the south and southeast (44%) and a secondary mode in the west and northwest (31%). As for the Transitional Archaic, northeast-facing sites were absent, but there were more east-facing sites (3) than during any other phase.

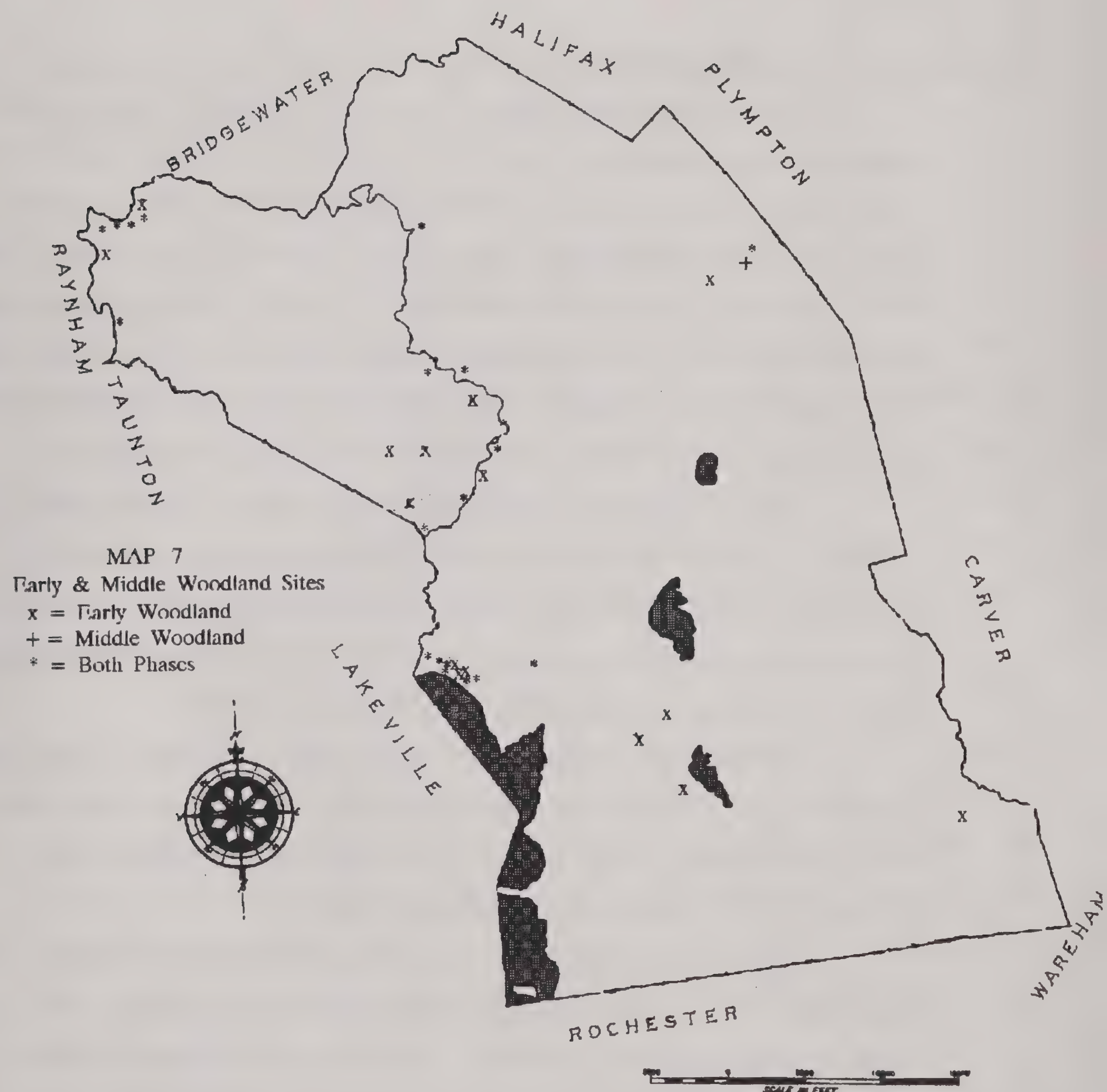
Distance to water also resembled Middle and Late Archaic patterns, with a strong mode between 30 and 75 meters (44%). Sites more distant than 250

meters were less frequent (14%), although one of these (MBO 65) was a single-component locus fully 575 meters from water.

Hypsometric integrals display a strong mode at 36-45% (47%), with a weak secondary mode at 15-20% (14%). As in the Late Archaic, some sites were occupied as far upstream as 61% (MBO 65, once again). Stream ranks show the pattern established since the Middle Archaic: 25% at rank 1, 31% at rank 2, 14% at ranks 16-20, and lesser percentages at other ranks. This once again reflects the concentration of sites in the major clusters around Fort Hill, Wapanucket, and Indian Hill.

Soil types are more selectively centered on well- to excessively well-drained soils (86%) than at any other period except the Paleo-Indian. Windsor soils, as usual, have a strong showing (42%). Slope patterns are again similar to those of the Early - Late Archaic, with 67% at 0-5 degree slopes and 33% at 5-15 degrees.

In conclusion, Early Woodland patterns more closely resemble those of the Late Archaic than they do those of the adjancent Transitional Archaic or Middle Woodland phases, in terms of aspect, proximity to water, hypsometric integral, stream rank, and slope. Soils choices are more selective, and the incidence of exotics is still moderately high. This return to earlier patterns has also been noted in other parts of southern New England (e.g. Hoffman 1985), but its causes are unknown. Single-component sites are much less common (11%) than in the preceding two periods. The presence of a few Adena-related artifacts (Adena points and a blocked-end tube pipe) suggests a weak connection to the Eastern Adena cult, which has been best documented for southern New England in the Connecticut Valley (Jordan 1980).


HALIFAX
PLYMPTON
BRIDGEWATER
RAYNHAM
TAUNTON
CARVER
LAKEVILLE
WAREHAM
ROCHESTER
MAP 7
Early & Middle Woodland Sites
x = Early Woodland
+ = Middle Woodland
* = Both Phases
SCALE IN FEET

7. Middle Woodland (see Map 7):

The Middle Woodland saw a decline in the absolute number of components (24), coupled with a decline in the number of single-component sites (4%). Exotic lithics are a bit more common than in the Early Woodland, but there is a shift from Onondaga and Coxsackie cherts to Pennsylvania jaspers. Mostly these were used for the manufacture of Jack's Reef and Greene points. Fox Creek Lanceolate points were more commonly made of black New York cherts. This pattern is well-documented elsewhere in the coastal plain of the Northeast (Luedtke 1986, Strauss 1990), especially for the Jack's Reef phase.

Aspect is strongly concentrated in the southern quadrant (63%). East, northeast, west, and northwest were generally disfavored, but examples of sites are present with all 8 possibilities. Distance from water is no greater than 250 meters, and there is a strong mode (33%) at 60-75 meters. This suggests a retreat to the most favored locations for this phase.

Hypsometric integrals also reflect this. There is a major mode at 36-45% (54%), and a minor mode at 15-20% (17%). Stream ranks also show this bimodal distribution, with 33% at rank 2 and 17% at ranks 16-20. These correspond to the Wapanucket and Fort Hill clusters.

Soils favored are again those with good drainage, especially Windsor soils (46%). No other soil type has more than 13% of the total. Slopes return to the Transitional Archaic pattern: 54% are at 0-5 degrees, and 46% at 5-15 degrees. This may reflect a concentration on hillier locations for incipient horticultural activities.

In conclusion, the Middle Woodland seems to represent a temporary decline in site concentrations, falling back to familiar multi-component

locations close to water in major clusters. Sites with south quadrant orientation, good drainage, and low to moderate slope were favored.

8. <u>Late Woodland</u> (see Map 8):

The number of sites for this phase rebounds to 31, including 3 single-component sites and 4 double-component sites (23%). However, there is a striking decline in the number of exotic lithics used (3 items). A similar decline from Middle to Late Woodland is attested in several other areas of southern New England (e.g. Luedtke 1986), though not everywhere (e.g. Feder 1983). One radiocarbon date of 790$\pm$65 B.P. (Beta-32326, ETH-5670) derives from this phase, from the isolated Read Co. site in the Sippican drainage (Hoffman 1989a). It is considered to be a hunting/tool-making location and lacks diagnostics.

Aspects reflect the usual emphasis on the southern quadrant (61%). For the first time since Early Archaic, no east-facing sites are attested. Distance to water is as variable as in the Late Archaic, with two modes at 50 meters (26%) and 150 meters (16%). More sites are located further than 200 meters from water (26%) than for any other period of prehistory, either as a raw number or as a percentage of the total. These include MBO 78, located 850 meters from the nearest water (see discussion of this site under the Transitional Archaic, however).

Late Woodland sites show a somewhat more constricted range of hypsometric integrals, between 16 and 59%. The strongest mode is between 36 and 45% (50%), with a secondary mode between 56 and 60% (18%). This suggests that locations further upstream were more favored, for reasons that will be clearer when horticulture is discussed. Stream ranks also show a strong correlation

with low order streams (55% at ranks 1 and 2). There is only a very weak mode at ranks 16-20 (10%, the Fort Hill cluster).

Soil types are distributed according to the familiar pattern; 84% are in well- to excessively well-drained soils, with 35% in Windsor soils. Slopes are evenly divided between shallow and moderate (48% each), with one site, MBO 62 (4%), on a steep slope. This is the same pattern as for Transitional Archaic and Middle Woodland.

In conclusion, Late Woodland sites show a greater selectivity in terms of aspect, hypsometric integral, and stream rank, with a more diffuse set of choices for distance from water and slope. Many of them seem to be located in well-drained upland settings away from major rivers, and they show some degree of isolation in terms of both number of components and scarcity of exotic lithics. This contrasts markedly with the impressions of early European explorers, who were impressed with the sturdy year-round coastal villages they witnessed. A symposium on this issue published in the M.A.S. Bulletin (Thorbahn 1988, Hoffman 1989b) concluded that these villages may have been strictly coastal and may lie under modern town and city developments, but that the interior continued a dispersed settlement pattern to the end of prehistory.

9. Contact (see Map 8):

Only eight sites are attributed to the Contact period, identified mostly on the basis of European trade goods, particularly ballast flint and metal objects. Some copper cut-out points and beads are known from Taylor's collections from the Fort Hill area (Taylor 1976, 1982), but these were not available to the inventory for personal reasons. With one exception, these sites are locations occupied for most of the prehistoric sequence. The

MAP 8
Late Woodland & Contact Sites

exception is a lone Levanna point of black chert found at the site of a colonial farmhouse (MBO 20) which was burnt to the ground during King Philip's War and never reoccupied. Other surface materials at this location are all of European manufacture, which suggested to the collector that this point actually derived from the raid.

The Contact period sites are found only with south, east, west, and northwest aspects, with a strong (50%) cluster in the south. Their distance from water varies between 50 and 175 meters, with a strong mode at 50 meters (63%). With the exception of the MBO 20, which is at a hypsometric integral of 61%, all of the sites are between 15 and 25% of the way upstream, with a strong mode at 41-45% (50%). Stream rank is bimodally correlated with low (2, 63%) and high (16-20, 38%) ranks. This represents the Fort Hill cluster and the Wapanucket area.

Once again, with the exception of the MBO 20, which is in poorly drained Wareham soil, the sites of this phase are in well-drained soils, with a strong mode for Windsor soils (50%). Slopes are mostly shallow (75%), with no slopes higher than 15 degrees.

In conclusion, Contact period sites are characterized by greater selectivity of site locations close to major rivers and ponds, and low to moderate hypsometric integrals, with good drainage and low slope. These sites are precisely the ones which attracted populations throughout prehistory. This could represent a population decline due to infectious diseases brought by Europeans, and a consequent regrouping at major centers, although given the nature of epidemic spread, one would think that the more populated areas would be more affected than the remoter locations favored during the Late Woodland. An alternative explanation is that European trade goods found their way into the

elite echelons of Native American society, where they were strongly associated with ritual behavior (including burials). Populations living in the margins of the central places, or task groups performing hunting or tool-making tasks away from them, would have had no need for these items and would have continued to use the older technologies to satisfy their needs. In this case, some of the sites represented as Late Woodland above might also be Contact period locations.

10. Sites of Unknown Age:

These sites form an important residuum, constituting fully 55% of all sites recorded in the inventory. Because they lack diagnostic artifacts, they cannot be assigned with any certainty to any particular age or ages, and it is impossible to know whether they were occupied more than once or not. In many cases, they are identified on the basis of very few artifacts, or even merely debitage. No exotic materials were recovered from any of these sites.

Aspects show a markedly different pattern from the sites of known age. There is a strong mode in the southwest and west (40%), and secondary modes in the east (15%) and northwest (14%). South-facing sites were not particularly favored (9%). East-facing and northeast facing sites of this category constitute more than half of all components with these orientations (56 and 70%, repsectively).

Distance from water is very difficult to characterize, since these sites are found at every distance from 10 meters to 875 meters from water, and no interval had more than 9% of the sites. Fully 41% were more than 200 meters distant from water. This suggests that many of the activities taking place at these sites did not necessitate the presence of water. However, 7% of the sites were closer than 25 meters to water, including some within the 100-year flood

zone of the Nemasket River. These present the interesting possibility that buried, stratified sites may be recovered within the flooplain.

Hypsometric integrals also span the entire range from 14 to 77%. There is a strong upstream mode between 51 and 65% (47%), which correlates with the distance from water parameter. Stream ranks are very strongly correlated with low order streams: 56% are on rank 1 streams and an additional 15% on rank 2 streams. The rank 1 sites of unknown age constitute 48% of all rank 1 components.

Despite the above variability, the tendency for soils to be well- to excessively well-drained is just as strong as for the dated sites (87%). The strongest mode is for Gloucester soils (36%). Four of the sites in poorly drained soils are in Saco very fine sandy loams, which are alluvial deposits in oxbows of the Nemasket and Taunton River. These are the locations which were alluded to above which have a possibility of being stratified. Slope is also strongly selective: 76% are on shallow slopes, 21% on moderate slopes, and 3% on steeper slopes. This 3:1 ratio of shallow to other slopes is stronger than for any sites with identified age except for Paleo-Indian.

In conclusion, sites of unidentified age show a strong correlation with well-drained soils and moderate slopes, but no particular preference for aspect, distance to water, hypsometric integral, or stream rank. It should be added that 21 of these sites (24%) have been investigated at the Intensive Survey level, during the course of several cultural resource management surveys performed in Middleborough. All are identified as flake scatters, or at best tool-making loci, probably representing in every case the isolated activities of hunters at locations distant from their base camps. Thus, the sites of unidentified age do not necessarily constitute a challenge to the model

developed above. Instead, they serve to confirm the hypothesis that the prehistoric inhabitants of Middleborough utilized the entire landscape, even though some of the uses were very light and left few traces.

B. Site Function (see Tables 8-13)

1. Ceremonialism (see Map 9):

Of all functions defined above, ceremonial activities are the most critical, given the importance of burials to the modern descendants of the prehistoric peoples of the region. While descendants of Euro-Americans may also have an interest in the grave sites of their colonial forebears, Native American concerns are far more central to their religious beliefs about the positive function the undisturbed dead are expected to provide for the living. Quite frankly, the disturbance of burials has become a rallying point for their political aspirations as a minority ethnic population in American society. This high level of concern has recently achieved legal recognition by the Federal government, and extends potentially not only to skeletal remains but to associated grave goods, ritual objects, and "cultural patrimony" (Kintigh 1991). In Massachusetts, the discovery of unmarked burials is the only situation in which the State Archaeologist may legally intervene in a development project which uses no public funds and requires no public permitting process.

Seventeen sites are recorded in the inventory at which ceremonial activity took place. The only cluster according to aspect is in the south (29%), and consists of 5 of the Wapanucket loci. No northeast-facing sites were used for ceremonial purposes. The southwest direction was not particularly favored (12%); this is in contradiction to received archaeological opinion that this direction was a favored orientation (Simmons 1970). However, a recent

MAP 9
Ceremonial Sites

study by McBride (1989) has shown that southwest orientation may have been restricted to a phase of the Contact period.

Distance to water is very varied, ranging from 10 meters to 850 meters. However, only 2 sites (12%) were further than 200 meters from water. A strong mode occurs at 50 meters (41%), including the Wapanucket sites and several others. Hypsometric integrals varied between 15 and 65%, with fairly even distribution below 50%. All ceremonial sites are within the Taunton drainage. Stream rank is similarly diverse, with minor modes at ranks 2 (29%), 4 (24%), and 16-20 (18%). Soils chosen tend to be well- to excessively well-drained (76%), with a major mode for Windsor soils (35%) representing the Wapanucket cluster. The ratio of shallow slopes to moderate approaches 2:1, with no sites on higher slopes.

Most ceremonial sites are located within or in close proximity to habitation activities, with only 3 single-activity loci and 3 dual-activity sites. In these cases, the maximum number of ceremonial artifacts recovered was 9. This may be contrasted with sites like Wapanucket 8, where 242 artifacts may be assigned a ceremonial function. Thus, while isolated burials and ceremonial caches may be located almost anywhere on shallow slopes with well-drained soils, the more important ceremonial sites are expected to be found at complex loci.

2. Clothes Processing:

A total of 23 sites showed definitive evidence of clothes/hide processing. East and northeast-facing sites were avoided, and there is a preference for sites in the southern quadrant (65%). Distance from water ranges from 25 to 400 meters, but only 2 sites (9%) are further than 200 meters from water. A major mode occurs around 50 meters (35%). Hypsometric integrals vary

from 11 to 60%, but only 1 site is above 50%, and there is a major mode around 41-45% (35%). Stream rank is very varied, with modes at ranks 1 (30%), 2 (26%), and 16-20 (17%). Soils are very strongly selected for good drainage (91%), with Windsor soils constituting 48% of the total. The ratio of shallow slopes to moderate is a little more than 3:2. These parameters fit well with the typical site selection criteria for most periods discussed under site age.

3. Fishing:

Seventeen sites have artifacts associated with fishing activities. In terms of aspect, the northern quadrant was avoided, and there is a mode of 41% for south-facing sites. What is more surprising, however, is that 30% of these sites are more than 125 meters distant from the nearest water, and fishing gear is absent from sites closer than 25 meters to water. The remaining sites are all between 25 and 75 meters from water, with a mode at 50 meters (35%). The more distant sites may represent staging areas where fishing apparatus was manufactured or stored prior to or subsequent to fishing activities.

Hypsometric integrals vary between 15 and 65%, with strong modes at 15-20% (27%) and 41-45% (40%). The latter represents the Wapanucket cluster. Stream ranks vary considerably, but there is a strong mode at rank 2 (47%), which also includes this cluster. Soil types are strongly selective of well- to excessively well-drained soils (82%), with 47% being in Windsor soils. The ratio of shallow to moderate slopes is 3:1, and there is one site on a more extreme slope (6%). Fishing is inferred as the sole activity at only three sites, at two of them on the basis of isolated projectile points found close to water, on the third on the basis of a solitary fishing or canoe weight. Fishing

apparatus is more commonly found at large, multi-purpose sites with the locational parameters common to those sites: good drainage, low slope, south aspect, relative proximity to water, and low to moderate hypsometric integral.

4. Food-Processing (see Map 11):

This is one of the most common activities inferred from assemblages, with 68 sites represented. As detailed in Section V, food-processing covers a wide range of activities that begins as soon as the plants or animals are retrieved and ends with consumption. A more detailed study, including some use-wear analysis (Keeley 1980, Shea 1985) could show more precisely what processes of preparation were involved, and the computer records actually allot space for this type of study in the future, but time constraints prevented the implementation of this during the present study.

Sites with all eight aspects were used for food processing. There was a general avoidance of northeast slopes (1%), and a preference for south-facing slopes (21%), but most aspects were close to average values. Distance to water was also extremely varied, but there was a strong mode between 25 and 75 meters (42%), and a secondary mode between 105 and 150 meters (19%). Fully 25% of the sites were further than 200 meters from water. This suggests that some food processing may have been taking place at kill sites rather than exclusively at base camps.

Hypsometric integrals also run the gamut of possibilities, with two modes at 15-20% (17%) and 41-45% (25%). Stream ranks were similarly varied, with the strongest mode at rank 1 (40%) and secondary modes at ranks 2 (21%) and 4 (15%). This tends to confirm the above suggestion that food processing was taking place at locations far upstream in drainage systems.

Soil preferences were, as expected, for well- to excessively-well drained soils (84%), with two strong modes for Gloucester soils (22%) and Windsor soils (29%). Since Gloucester soils form on the higher parts of rolling ground moraines (USDA 1969:80), this is further confirmation of the above hypothesis. The ratio of shallow to moderate slopes is about 5:2, and one site is located at a more extreme slope.

Because food-processing sites are very common, including 13 single-activity sites (19%) and 15 double-activity sites (23%, most usually paired with tool-making), it is probable that they are more representative of the total distribution of sites in Middleborough than some of the more specialized functions. This is indicated by all of the environmental parameters. While there are some clear preferences for soil type, distance to water, stream rank, and slope, it is evident that this function could have been performed practically anywhere in town.

5. Food Storage (see Map 10):

Current foraging theory in archaeology suggests that a transition from day-to-day acquisition of fortuitous food resources to long-term collection of specific resources for storage is an important evolutionary change among hunter-gatherers (Binford 1980). This model has been applied with some success to the Taunton River drainage (Thorbahn 1984) as well as other locations in southern New England (e.g. Pagoulatos 1988). Populations which store foods must at least regularize their wandering patterns so as to retrieve food caches. They may also tend to become more sedentary, since containers (especially when full) are heavy to carry. Current evidence suggests that very few, if any, populations in southern New England were fully sedentary at the time of European

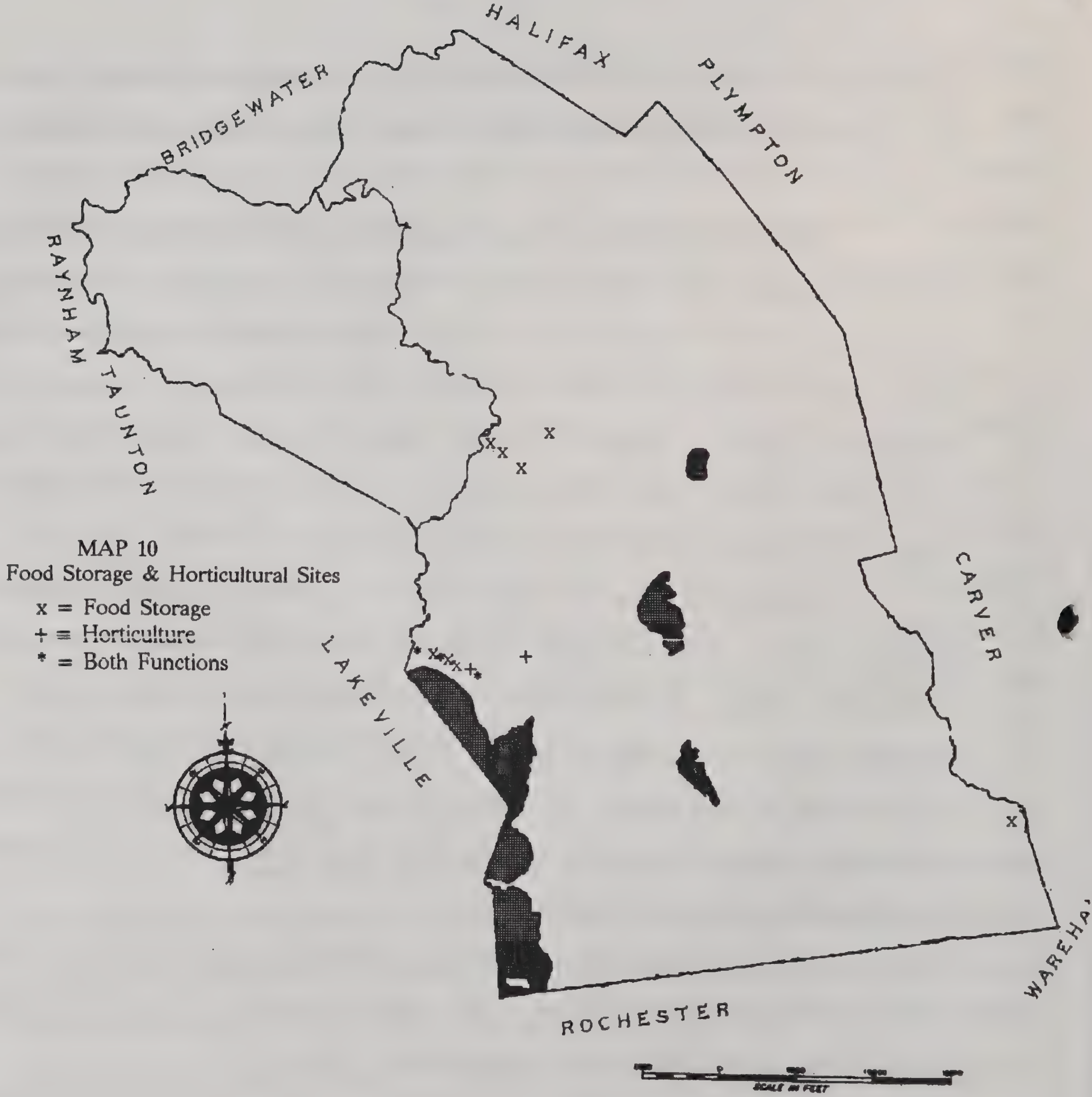
contact, but they may have returned annually to important seasonal campsites, and collecting groups may have needed to store foods over several seasons of the year.

Sites with evidence of food storage are fairly infrequent (12 cases), which is perhaps not surprising since their use is generally thought to be confined to the last third of prehistory. Sites with east, west, and northwest aspects were avoided, and there is a mode of 41% in the south, representing the Wapanucket cluster. Distance to water, while it varies from 25 to 575 meters (the latter being a single steatite sherd from MBO 117), has a strong mode at 50 meters (50%), again mostly representing Wapanucket.

Hypsometric integrals vary between 36 and 77%, the latter representing MBO 117 again. A strong mode of 58% at the 41-45% integral includes the Wapanucket cluster. Stream rank is very restricted, with no ranks higher than 4 attested, and a strong mode at rank 2 (58%). No sites from the Fort Hill area are included in this group. It should be noted that Bill Taylor mentioned the presence of pottery at sites in the Fort Hill area, but we were unable to inventory this part of his collection.

Soil types are also restricted to excessively well-drained sites, with a mode of 58% for Windsor soils. The ratio of shallow to moderate slopes is 8:3, with one site (MBO 62) at a more extreme slope.

With only two exceptions, food storage is an activity which took place at multi-function sites, especially in the Wapanucket cluster. Therefore, sites with high complexity are the most likely to demonstrate this activity, and the site selection parameters for them are likely to be good predictors for food storage also, at least for sites in the latter third of prehistory.



MAP 10
Food Storage & Horticultural Sites

6. Horticulture (see Map 10):

This activity is even more temporally confined than food storage, since current research has documented no cultigens at sites earlier than about 1000 B.P. in southern New England (Lavin 1988). No actual cultigens have been reported from Middleborough sites, although the deep pits at Pratt Farm 1 are suggested as corn storage features (Brady Fitts, personal communication). However, 5 sites contained hoes or spades that could have been used in horticultural activities.

All five were located in the southern quadrant, which would tend to increase the number of frost-free days before Fall harvest. Four of the five are between 50 and 75 meters from water, the exception being the Willis Hill South site at 225 meters. This location is at a hypsometric integral of 58%, otherwise horticultural sites are constricted to the 36-45% range. Stream ranks are no higher than 3, with a mode of 60% at rank 2. All were located in excessively well-drained soils, with 80% in Windsor soils. All were on shallow slopes.

The horticultural sites are highly selective in nature, and all of them were large, multi-function sites in the vicinity of Assawompsett Pond. Despite historical accounts of Indian corn fields in the area of the great bend of the Nemasket River (Weston 1906), no horticultural implements have been documented from that area, and none are known from the Fort Hill cluster, either, despite the current use of that area as agricultural land. It is suggested that this represents a bias in the available data that could be corrected through further research at large, multi-function sites.

7. Hunting (see Map 11):

Projectile points were the single most common tool type in the inventory (43% of all tools). While this is certainly due to collector bias, as discussed above, it did result in a large number of sites (66) with evidence of hunting activity. As with food-processing sites, aspects varied in all directions, with a relative avoidance of northeast-facing sites (5%) and modes to the north (15%) and south (23%). Distance from water was also very variable, with the strongest mode at 50-75 meters (32%) and a total of 18% further than 200 meters from water. Hypsometric integrals did not exceed 65%, with modes at 15-20% (17%) and 41-45% (23%). Stream ranks ran the gamut, but with strong modes at ranks 1 (26%) and 2 (29%). Soils were very variable, but 88% were in well- to excessively well-drained soils, and 30% were in Windsor soils. The ratio of shallow to moderate slopes was 2:1, and there were 3 sites at higher slopes (5%).

This distribution is very similar in most respects to that for food-processing sites, with the exception that projectiles were rarely found in Gloucester soils (6%), and were more likely to be found in shallow slopes. Sixteen single-function (24%) and eleven dual-function (17%) hunting sites are recorded, a similar total to that for food-processing. This suggests that hunting was an activity which could be carried out in many types of locations, and that the products of hunting technology would likely be found both at multi-function base camps and at isolated locales.

8. Tool-Making (see Map 11):

This is the most common of all activities recorded, with 92 sites, 58% of the total. It is likely that this is a conservative

Map 11
Single-Function Sites

estimate, since the presence of debitage was not included unless it was the only type of recovery from a site. Potentially, stone tool-making could have taken place at every site inventoried, including some very isolated locations. Tool-making was the only activity recorded at 51 of these sites (59%), the highest percentage of activities for single-function loci. These also constitute the majority of the sites of unknown age, for the reason that cores, preforms, and broken tools are among the most difficult to type.

Aspect is very variable, with a relative avoidance of northeast-facing sites (4%) and a strong preference for sites in the quadrant from west to south (52%). A secondary mode occurs in the north (15%). Distance to water is more varied than for any other site type, with 29% being further than 200 meters from water. The strongest mode is between 50 and 75 meters (26%).

Hypsometric integral is also very varied, with modes at 15-20% (19%), 36-45% (27%), and 56-65% (23%). Sites of this type have the highest frequency of any function outside of the Taunton drainage (20%), indicating their greater dispersal. Stream ranks are somewhat more restricted, with no sites at the rank 6-10 range or at ranks above 20, and there is a very strong mode at rank 1 (54%). A secondary mode of 13% occurs at rank 2. This again suggests dispersal throughout the town, including some upland locations near the headwaters.

Soils, however, are less varied than at hunting or food-processing sites, with 89% in well- to excessively well-drained soils. There is a suprisingly large mode for Gloucester soils (35%), with smaller secondary modes for Windsor (21%) and Hinckley (15%) soils. The ratio of shallow to moderate slopes approaches 3:1, with 3 sites on more extreme slopes (3%).

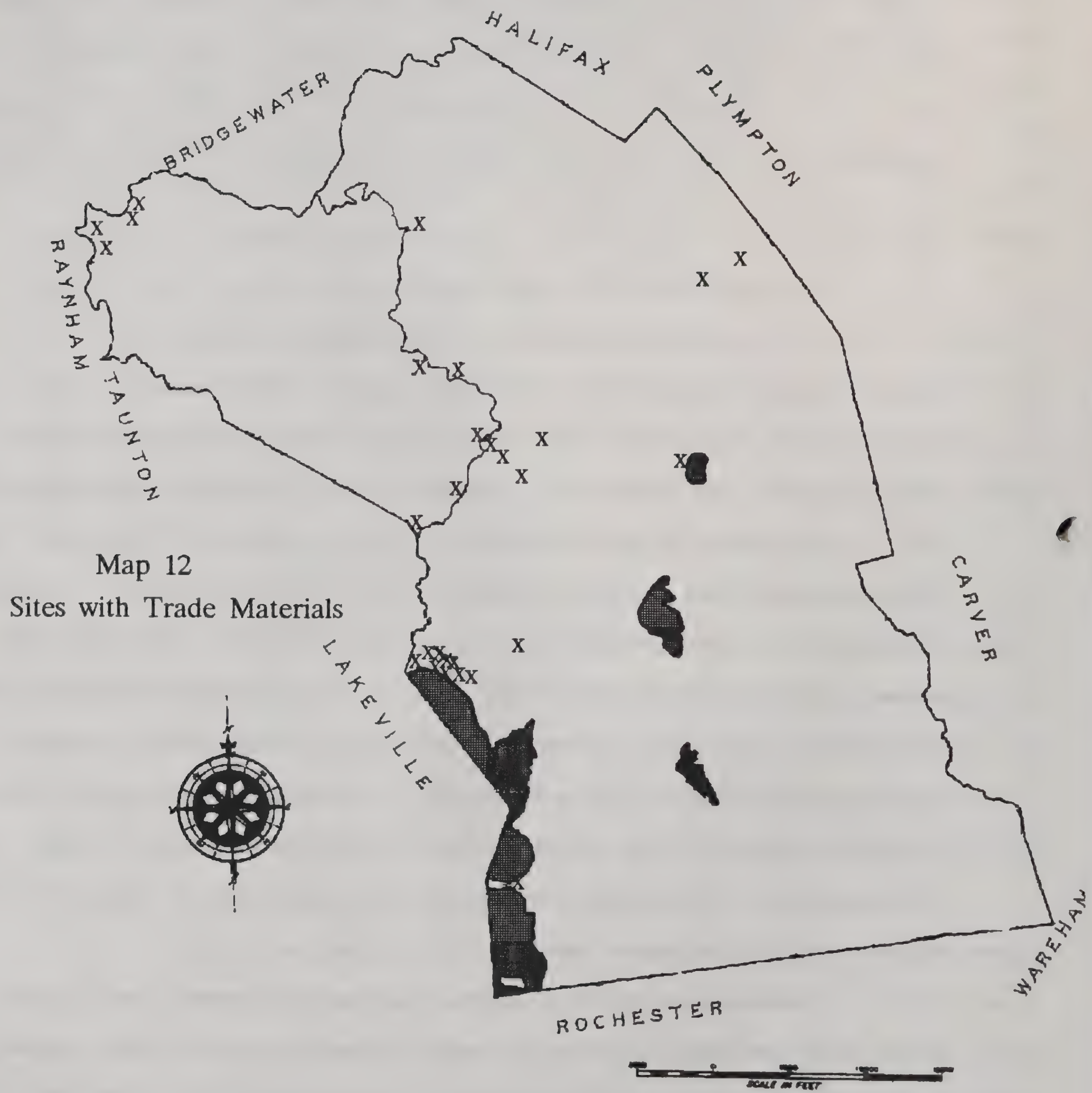
In conclusion, tool-making sites tend to be located in somewhat excessively well-drained soils at shallow slopes, often far upstream in drainage

systems, with few clear choices for aspect, hypsometric integral, or distance to water. As was the case for food-processing and hunting, the frequency of these sites is a corrective to the impressions of restricted site locational parameters which would have been derived from a study of the sites on file at M.H.C. prior to the inventory.

9. Trade (see Table 15 and Map 12):

Long-distance trade is represented at 29 sites, a fairly high number (16%) relative to other town in southeastern Massachusetts. Trade items were recovered from sites with all aspects except northeast, but only one east-facing site was encountered. There was a strong mode at south-facing sites (38%). The same percentage characterizes sites 50 meters from water, though trade items could be found as distant as 500 meters from water. Hypsometric integrals are very varied, but a mode of 39% is at 41-45%. The major mode for stream rank is at rank 2 (41%), with no particularly pronounced secondary modes. Windsor soils absolutely dominate at 48%, with a total of 86% from well- to excessively well-drained soils altogether. These five factors are strongly influenced by the presence of trade goods at all of the Wapanucket sites except for Wapanucket 7. The ratio of shallow to moderate slopes is close to 2:1, with only one site at a higher slope.

Because trade is inferred from tool material rather than function, no single-function trade sites could exist. However, only 4 trade sites were dual-function. Most sites at which trade goods were found are large, multi-function sites, particularly those in the Wapanucket, Fort Hill, and Muttock clusters. These may have served as foci for the distribution of trade items to more isolated locations. The presence of such a large quantity of



Map 12
Sites with Trade Materials

trade items in Middleborough sites throughout prehistory attests to Middleborough's centrality within the trade networks of southern New England, and it may allow inferences about emergent social inequality and elitism, especially when trade materials were used to manufacture ceremonial goods, as they were at 9 sites (31%).

10. Woodworking:

Sites containing artifacts used in woodworking are fairly uncommon (18 sites). In terms of aspect, they are rather diffuse, with only the northwest direction avoided. There are modes in the west (22%) and south (28%). Distance to water varies between 25 and 300 meters, with a mode of 33% at 50 meters representing the Wapanucket cluster. Only 11% are further than 200 meters from water. Hypsometric integrals vary between 15 and 60%, with a mode of 50% between 36 and 45%. Stream rank is quite variable, but the only mode is at rank 2 (33%), again representing the Wapanucket cluster. Woodworking is strongly oriented toward Windsor soils (56%), but 17% are in very poorly drained alluvial soils. Slope characteristics are unusual, with 44% on moderate slopes and the remainder on shallow slopes. This is by far the highest percentage at moderate slopes of any function, and may reflect the use of woodworking tools on forested slopes.

For the most part, woodworking is restricted to multi-function sites. However, there are 4 single-function wood-working sites, and 1 dual-function site (total 28%). Most of these have only 1 or 2 artifacts, however.

In conclusion, the ten functions described above may be divided into three groups: those found almost exclusively at multi-function sites (food storage, horticulturalism, and trade), those found more frequently at

multi-function sites (ceremonialism, fishing, clothes processing, and woodworking), and those widely dispersed throughout the town (food processing, hunting, tool-making).

C. <u>Complexity</u> (see Tables 8-14):

The majority of sites (58%) were single-function; only 11% exceeded four functions. All of these were located in the Taunton drainage. Aspect mattered little for single- and dual-function sites, but 65% of the sites with five or more functions were located from west to southeast. East and northeast were avoided for sites with more than than three functions. Distance from water also varied fairly randomly for single- and dual-function sites, but never exceeded 400 meters for sites of greater complexity. Only one site (6%) with more than 5 functions was situated further than 150 meters from water, and only 2 of these sites (12%) were closer than 30 meters to water. Hypsometric integral covered the entire possible range for single- and dual-function sites, and was widely dispersed for triple-function sites, but only one site (6%) with five or more functions exceeded 50%. Stream ranks for single- and dual-function sites were highly skewed toward ranks 1 and 2 (73% for single and 74% for dual), but sites of these types were also found with high stream ranks. More complex sites had a diverse variety of stream ranks. Sites with fewer than five functions could be found in any soil type, with a strong mode for Gloucester soils for single-function sites (28%). In general, well- to excessively well-drained soils were preferred for the simpler sites (85% of single-function, 77% of dual-function), but only one site (6%) with 5 functions or more was in poor to moderately well-drained soil, and Windsor soils predominated for these sites (65%). Low slopes were preferred for sites of all levels of complexity.

In simple sites, the ratio of shallow to moderate slopes was between 3:1 and 6:1. However, a surprisingly high 35% of sites with more than 5 functions were located on moderate slopes. No sites with more than 3 functions were located on more extreme slopes.

These data suggest that single- and dual-function sites could be located almost anywhere that slopes were shallow and stream rank was low, especially in well-drained soils, but irrespective of aspect, distance to water, and hypsometric integral. Complex sites were most likely to be located in areas which were south- to west-facing, relatively close to water, with low to moderate hypsometric integral, on well- to excessively well-drained soils, irrespective of stream rank and slope. The near exclusivity of these locational preferences with respect to environmental parameters (with the exception of soil type) suggests that they actually represent conscious choices on the part of the occupants in both cases. In effect, this means that the simpler sites do not represent a "background count" against which the more complex sites stand out, but rather that they were an integral part of the settlement system (Hoffman 1989b).

D. Redundancy (see Tables 8-14):

Site redundancy is much more varied in its distribution than complexity. Of the 73 sites with known ages, the number of single-component sites is fairly high (36%), but sites with 5 or more components are equally numerous. Aspect shows little patterning, with south quadrant sites only slightly more numerous for multi-component loci (58%) than for single-component loci (46%). Percentages for sites with 2-4 components are similar (55%). East and northeast directions were avoided for sites with 5 or more components,

however. Distance from water shows more selectivity for multi-component sites: only 3 (12%) are more than 200 meters from water, and only 2 (8%) are closer than 30 meters from water. Among single- and dual-component sites, distance from water is very variable, with 24% further than 200 meters from water. Hypsometric integrals for single- and double-component sites are similarly variable, with 32% above 50%. For sites with 5 or more temporal components, only 12% are above the 50% integral, and none are below 15%. Stream ranks for single-component sites are heavily skewed toward the lower end of the range, with 50% at rank 1 and 31% at rank 2. No particular pattern could be discerned for multi-component sites with regard to stream rank, and sites with as many as 8 components could be found at rank 1 streams. No particular patterns could be discerned with regard to soil type, other than the common tendency of all sites to be located in well- to excessively well-drained soils. However sites in poorly drained soils were twice as likely to be single- or dual-component as to be used more repeatedly. Sites on moderate slopes were slightly more likely to be single- or dual-component (52%) than multi-component (48%), and no sites with more than 2 components were located on more extreme slopes.

The conclusion that may be reached from this is that multi-component sites are likely to be located close to water, at low to moderate hypsometric integrals, on low to moderate slopes, not facing east or northeast, regardless of other aspect choices or soil types. Single-component site locations were more varied, with a strong tendency to be located at low stream ranks, regardless of other parameters. This suggests that either redundancy is not strongly correlated with environmental parameters, or that perhaps the samples from the presumed single component sites are non-representative of their temporal range. Since the evidence for complexity shows strong patterning

according to environmental variables, the first of these hypotheses is considered more likely to be generally correct.

E. Intensity (see Tables 8-14):

Intensity of artifact recoveries at a site is necessarily influenced by the intensity of archaeological investigation. The number of recoveries from the excavated locations at Wapanucket, Fort Hill, and Pratt Farm 1 is far in excess of those in most surface collections. Even factoring in the number of components so as to approximate the number of artifacts in use at one time is insufficient to eliminate this bias. However, some general statements about intensity can be made.

Components with an average of 10 or fewer artifacts are widely scattered in choice of aspect. For sites with greater intensity, there is a general avoidance of east- and northeast-facing sites (5%), but no other preferences are evident. Distance to water is also very variable for sites with intensity of 5 or less, but distances further than 200 meters are uncommon (10%) for sites with higher intensity, and sites closer than 30 meters are absent for intensities greater than 10. Hypsometric integrals are similarly varied for sites with intensity of 5 or less, but rarely (10%) exceeds 45% for more intensely occupied sites. Integrals less than 20% are rare (10%) for sites of intensity greater than 10 artifacts per component. Stream rank is also more variable for intensities of 5 or less, with 64% in ranks 1 and 2 for sites with 1 or 2 artifacts and 58% in ranks 1 and 2 for sites with 3-5 artifacts per component. However, most of the sites with stream ranks higher than 4 (74%) are also at these low intensities. Soils at low intensity sites are varied, with 28% in poor to moderately well-drained soils. For sites with intensities

greater than 5, well- to excessively well-drained sites are absolutely dominant (96%). Slopes are more difficult to characterize, with ratios of shallow to moderate slopes varying between 4:1 and 2:1. Sites on moderate slopes are somewhat less common (22%) on sites with more than 10 artifacts than on sites with 10 artifacts per coponent or less (32%). Sites on more extreme slopes have intensities of 15 or less.

These data suggest that the less intense sites could be located irrespective of aspect, distance to water, hypsometric integral, soil type, and slope, though low stream ranks predominate. More intense sites tend to be located away from east and northeast aspects, moderately close to water, on moderate hypsometric integrals, and on well-drained soils, irrespective of stream rank or slope. While these conclusions are similar to those for complexity in terms of being mutually exclusive, they are less clear-cut. Sites of high intensity (which also tend to be those of multiple functions and components) display high selectivity in terms of environmental variables, but sites of low intensity do not seem to be easily characterized.

F. <u>Clustering</u> (see Table 14 and Maps 13 and 14):

Correlating distance to nearest neighbor with complexity, it is evident that single- and dual-function sites are very variably distributed. There is a strong mode at 100-300 meters (38%), but there are secondary modes for single-function sites at 500-600 meters (16%) and 800-1000 meters (12%). All but one of the sites more than a kilometer distant from nearest neighbor have fewer than 3 functions (94%). Sites with 5 or more functions tend to be clustered within 100-500 meters of each other (75%). This suggests a model in which certain functions such as tool-making, hunting, and food-processing might

MAP 13
DISTRIBUTION OF MIDDLEBOROUGH SITES BY SQUARE KM.

																					TOTAL
								1	0												1
						0	0	0	0	0	0										0
						0	0	1	0	0	0	0	1								2
	0	5	1	1	0	0	2	4	1	0	0	0	2	0							16
	4	4	0	1	0	0	4	2	0	0	1	0	0	1	0						17
	0	0	0	1	0	0	3	1	0	0	0	0	2	1	0						8
	1	2	0	1	0	0	1	3	0	1	1	2	0	1	0	0					13
		0	0	1	0	1	1	6	1	2	0	2	1	0	1	1					17
				1	0	2	2	7	14	2	2	1	1	0	0	0					32
					0	0	2	5	4	2	1	0	0	0	0	0					14
							1	1	1	2	0	0	1	0	0	0					6
							0	1	1	2	0	1	0	0	0	1	0				6
							1	4	5	3	0	0	1	0	0	0	0				14
							0	7	3	1	0	1	1	1	1	0	0	0			15
								0	2	1	1	1	1	0	1	0	1	0			8
									1	1	0	0	1	0	0	0	0	2	1		6
									0	1	0	0	0	0	0	0	0	1	1		3
									1	1	0	0	0	1	0	0	11	0	0	0	14
									0	0	0	0	0	0	0	0	0	0	0	0	0
									0	0	0	0									0
TOTAL	5	11	1	6	0	3	17	43	34	19	6	8	12	5	3	2	12	3	2	0	192

be taking place in diverse, task-specific locations distant from base camps, while the base camps themselves might not be tied down as to exact location so long as it fell within the confines of a particular cluster.

The nearest-neighbor correlation with redundancy shows a similar pattern. Single- and dual-component sites might be located at any distance from nearest neighbor, with a mode for single-component sites at 200-300 meters (31%). This again includes all of the sites more than 1 km. apart. Almost all of the sites with more than one temporal component are located within 100 and 500 meters of nearest neighbor (91%). This also suggests that the multi-component loci are strongly attracted to specific areas. It should be recalled that our control of the temporal variable in New England is never better than the century, and often less precise, even when we do have radiocarbon dates. Clusters, therefore, should not necessarily be taken to represent groups of sites occupied simultaneously.

Correlations of nearest neighbors with intensity are similar. The lower intensity sites may be located at any distance from nearest neighbor, with a mode of 28% for sites with intensity of 1-2 artifacts per component at a distance of 200-300 meters. Almost all of the sites further than 800 m. apart have 5 artifacts per component or less (78%). Most sites with intensity of more than 5 artifacts are between 100 and 500 meters apart (75%).

Using 500 meters as a cut-off is of some significance, since it suggests that one can use the 1 km. square quadrats of the UTM system on U.S.G.S. maps to examine clustering. The clustering map produced thereby (Map 13) has 5 areas where the sum of adjacent 1 km. quadrats was 5 or more: the area of Fort Hill; the Warrentown-White Oak Island area; the Muttock-Downtown area, where the Nemasket makes its great bend; the Wapanucket area; and a small

area in the southeastern part of town. All of these clusters contain at least 11 sites. The latter cluster is of little significance, since it consists of 11 closely spaced loci defined on the basis of an intensive cultural resource management survey, only one of which produced artifacts (Hoffman 1989a). These 11 sites will be counted as being outside of clusters for subsequent analysis. All of the other clusters incorporate at least five 1 km. grids. The central Nemasket cluster might intuitively be divided in two, with the sites south and east of the center forming one group and those north of the center the other. These are referred to as the Indian Hill and Muttock clusters, respectively. It should be noted that four of these clusters were known prior to this inventory, both through M.H.C. files and local folklore, and there were publications on sites within three of them. Only the Warrentown-White Oak Island cluster was previously undocumented. It contains 17 sites. The inventory has added a significant number of sites to M.H.C. inventories within each of the other clusters (12 in the Fort Hill cluster, 8 in the Muttock cluster, 31 in the Indian Hill cluster, and 8 in the Wapanucket cluster)

Outside of these clusters, there is a large amount of relatively empty area in the town where sites are unknown or infrequent. Fully 56% of all quadrats were devoid of sites (this includes 45 quadrats, 20%, which overlapped the edges of the town, and which consequently contained less than a full square kilometer of area). A total of 27% had only one site (these included 12 quadrats on the boundaries of the town, or 5%). Specific areas where few sites are known are the Taunton River both south and east of the Fort Hill cluster, the Purchade area, the area around Great Cedar Swamp, the Thomastown area around Tispaquin and Woods Ponds, the Black Brook-Rock Village area, and the Rocky Gutter area. It is likely that this is due in part to the under-reporting of

sites in these areas. Only 18 of the 76 sites outside of the clusters were previously reported. However, part of the reason sites were under-reported is that archaeological "folklore" has somewhat biased serious collectors against these areas. While it is not anticipated that any major clusters of sites have been missed by the inventory, some minor clusters of the intensity of the Warrentown-White Oak Island cluster (which was, in fact, overlooked by most collectors) may exist in various parts of the town: specifically, there is currently enough data to suggest that this may be the case in the Rock Village, France, and Eddyville neighborhoods.

The distributional data discussed above do suggest that certain areas were used more frequently, more intensively, and for a greater number of purposes, and these correspond almost perfectly with the five clusters described. While Late Archaic, Transitional Archaic, Late Woodland, and unknown period sites are well represented outside of clusters (including some single-component sites), Paleo-Indian, Early Archaic, and Contact period sites are represented by only one site each outside of clusters. Middle Archaic, Early Woodland, and Late Woodland sites are significantly less common outside of clusters. Fishing, food-processing, hunting, and tool-making are reasonably well represented outside of clusters (see Map 11), especially at single-function loci, but ceremonialism, clothes-processing, food storage, trade, and hunting are very weakly represented, and there are no horticultural sites outside of clusters. Only 3.5% of all trade lithics derived from non-cluster sites, as compared to 8.6% of all artifacts at these sites.

One interesting final point is that the sites in the clusters seem to be distributed close to riverine resources, irrespective of which side of the river they are on. This is most obviously evident at the three Nemasket River

clusters, but it is also true of the Wapanucket cluster, which could be extended to include several important sites in Lakeville, and the Fort Hill cluster, which certainly includes at least Titicut and Seaver Farm in Bridgewater. It is possible that the sites in the France neighborhood close to the west bank of the Weweantic River, which are too few in number to form a cluster in Middleborough, may be matched by sites on the Carver side of the river. The same may be true of sites in Eddyville on the west side of the Winnetuxet River, which may have counterparts in Plympton and Halifax. This cis-riverine tendency is one which has not before been explored in the archaeological literature, to the author's knowledge. It may represent a useful direction for future research into settlement patterns in the region.

G. Conclusions

In summary, the Town of Middleborough has been found to be extraordinarily rich in prehistoric resources of all phases of prehistory and of many different types. Essentially, the model confirms two impressions presented at the beginning of this report: that Middleborough held a special place in the minds and hearts of its prehistoric inhabitants, and that, consequently, prehistoric cultural materials may be expected to be found practically anywhere in town. This includes some sites in very counterintuitive locations, such as steep hillsides, floodplains, and selected locations within swamps. Other than areas actually under water or in muck or peat (and this exclusion is not absolute either, since many lake, swamp, and bog levels have been altered due to historic period agricultural activities), only locations which have been completely disturbed through subsequent construction may be safely ruled out as potential sites.

However, certain sets of environmental and cultural parameters are clustered in significant ways, and these reveal much about the settlement systems of the Native Americans. Specifically, sites with southeast to west aspect were preferred and those with north and northeast aspects disfavored. Sites further than 400 meters from water were infrequent, and those more than 250 meters from water tended to be single- or dual-function sites concentrating on tool-making, food processing, and/or hunting. Neither hypsometric integrals nor stream ranks were accurate predictors of site location, although most complex sites were located at low integrals and moderate stream ranks. Distribution by slope certainly favored sites on lower slopes, but not disproportionate to the amount of land surface available in town.

The best indicator of site locations seems to be soil type. Of the 20 soil types present in the town, only four (Brockton, Hollis-Charlton, Ninigret, and Walpole) contained no sites. However, there was a strong tendency for sites of all phases and of all functional types to be located on well- to excessively well-drained soils. Of the four soil types not represented, only Hollis-Charlton soils meet this criteria, and they are so infrequently found in Middleborough that the absence of sites in them could be due to chance. Windsor soils were particularly favored, and these included some sites in all of the clusters except Fort Hill. Gloucester soils were also favored, but more frequently for outlying, less complex sites.

The zone map (Map 3) divides the Town into seven zones, based upon these criteria. Zone 1 ("high probability") represents the five clusters and is considered to be the most archaeologically sensitive. Zone 2 ("moderate probability") includes areas outside of clusters which contained sites and which met at least two of the above criteria for probability of finding sites. Zone 3

("low probability") includes areas outside of clusters which contained sites but which met no more than one criterion for finding sites. Zone 4 ("high probability") includes areas which have not yet produced sites, but which meet all three of the criteria for finding them. Specifically, these are located on shallow to moderate slopes, within 400 meters of water, on Windsor, Hinckley, Merrimac, or Gloucester soils. Zone 5 ("moderate probability") includes areas which meet the slope criterion but are either more distant than 400 meters from water in the above soil types, or are in other well-drained soils (Deerfield, Essex, Carver, Raynham, Agawam, Belgrade, or Hollis-Charlton). Zone 6 ("low probability") includes areas which have not yet produced sites, but meet one criterion for finding them. These would include steeper slopes in well-drained soils, or locations in poorly drained soils (Saco, Birdsall, Au Gres/Wareham, Norwell, Scituate, and Scarboro). Finally, Zone 7 ("very low probability") includes areas which have not yet produced sites and are very unlikely ever to do so, because of their lack of environmentally conducive parameters. These include locations in muck, peat, or open water, or in very poorly drained soils that have not produced any known sites (Ninigret, Brockton, Walpole).

VII. RECOMMENDATIONS TO THE TOWN

At a time when the life-ways of the Indians are undergoing reevaluation and revalidation, while simultaneously development pressures are increasing in all parts of town, the Historical Commission and the Natural Resources Preservation Committee are presented with both a dilemma and an opportunity. The dilemma is how to ensure the long-term preservation of the cultural resources in the ground under the currently inadequate system of state and Federal regulations, while at the same time acknowledging the importance of increasing the tax base of the Town and allowing for the growth of industry, housing, employment, and the service economy. The opportunity is represented by the fact that such a large number of important prehistoric sites has been revealed by the inventory process, and publicized in local media, that the awareness of citizens of the importance of these resources is probably at a high point.

To respond to this situation, the Principal Investigator offers the following series of recommendations to the Town, with the understanding that he will be willing to serve in a consultative role in their implementation.

A. Testing the Model:

It is important to test the model against field conditions, to determine its accuracy. It is for this reason that the Principal Investigator has chosen to conduct field school activities in the summer of 1991 within the Town of Middleborough. The area chosen for the survey is the Commonwealth Electric powerline right-of-way, which runs for about 7 km. through Middleborough from the confluence of the Taunton and Nemasket Rivers approximately southeastwards over the western portion of White Oak Island and

Beaverdam Swamp, and then turns east-southeastwards to cross Meetinghouse Swamp and traverses the eastern portion of Middleborough until it reaches the Carver line north of Purchase Street.

This transect was chosen for several reasons. First, the area has been clear-cut, making location of test units simpler than in heavy woods. Second, it traverses several different environments and soil types, enabling a thorough test of the model's environmental parameters. Third, few prehistoric artifacts were reported from within the right-of-way during the prehistoric inventory of the town. Three sites are reported in M.H.C. files (19PL397, 411, and 415) from the Ray Seamans Jr. Collection (Mahlstedt 1985), but the artifacts from this collection were not made available to the inventory team, and only a few artifacts from other collections derived from two of these locations. Only one cluster, the Warrentown-White Oak Island cluster, is traversed by the transect, and this is the least known of the 5 clusters. One site in this cluster, MBO 116, was located by a C.R.M. survey on another power line near its junction with the Commonwealth Electric line (Pagoulatos and Leveillee 1988), but only debitage was recovered from this location. Thus, the Commonwealth Electric line represents nearly a complete unknown archaeologically. This is helpful in ensuring unbiased testing of the project area.

The sampling strategy for this project will be nearly identical to that used in by the author for the North River Archaeological Project (Hoffman 1986, 1987, 1989b, 1991b). Within consenting properties, transects will be set up parallel to the axis of the powerline. Excepting locations in the Nemasket River, Beaverdam Swamp, Meetinghouse Swamp, and a small unnamed wetland about Rocky Meadow Brook near the Carver line, units will be selected using a random number generator to determine the interval between 25 and 50 meters. This

sampling strategy has been found to be an effective means of locating prehistoric sites in the North River drainage, especially in Transects V and VI in Pembroke, Transect VII in Hanson, where 95 - 98% of the test units contained prehistoric cultural materials.

Recent discussion among survey archaeologists has tended to support the conclusion that the excavation of units containing no cultural material does not necessarily indicate the absence of sites (Hasenstab 1984), even when these units have been selected with an element of randomness to eliminate bias. When a sampling design of this type and intensity retrieves cultural remains in 98% of its units, regardless of such intuitively selected parameters as slope and distance to water, the conclusion that materials are generally spread throughout an area is difficult to refute. Precisely for this reason, the Principal Investigator considers it necessary to maintain the previous sampling strategy for the 1991 field season.

Fifty-centimeter square units will be excavated in 5 centimeter levels within natural soil horizons, using hand tools (trowels and onion hoes). All soils will be screened, using 1/4" mesh screening. All cultural materials (fire-cracked rock, historic materials, prehistoric materials, and organics) will be recorded and placed in bags corresponding to each level. In the event that features are uncovered, they will be sectioned, profiled, and photographed, and soil samples will be taken. All excavation units will be profiled on two adjacent walls upon completion, or to the maximum depth reached, and backfilled.

The presence or absence of flake scatters and diagnostic artifacts (indicating age and/or function) will be sufficient information for the testing of the present model. Once sites are located, future investigations could be

conducted on them to determine their function and significance, but this would transcend the boundaries of the present application.

Field operations will commence on July 9th and continue on Tuesdays through Fridays until August 16th. The number of units excavated will depend upon enrollment in the Field School, as well as soil conditions and density of recoveries. All field operations will be under the direct supervision of the Principal Investigator. The field crew will consist of students from Bridgewater State College and trained volunteer members of the Massachusetts Archaeological Society.

Following the completion of fieldwork, in the Spring of 1992, a summary report will be prepared describing the results of field testing. A copy will be sent to M.H.C., along with site file forms. Copies will also be submitted to the Town of Middleborough, to Commonwealth Electric, and to property owners on whose land excavation took place. A copy will also be sent to the Office of Public Archaeology, Boston University, which is conducting a locational study of the Assawompsett/Quittacas Pond Complex for the City of New Bedford (Elia 1990). While the transect does not include any portion of their study area, it may be helpful to them in formulating their locational models.

B. Establishing National Register Districts:

The National Register of Historic Places is a Federal program established under the National Historic Preservation Act of 1966 to help preserve significant cultural resources of both historic and prehistoric periods. Four criteria have been established for significance:

1. The property is associated with events that have made a significant contribution to the broad patterns of our history; or

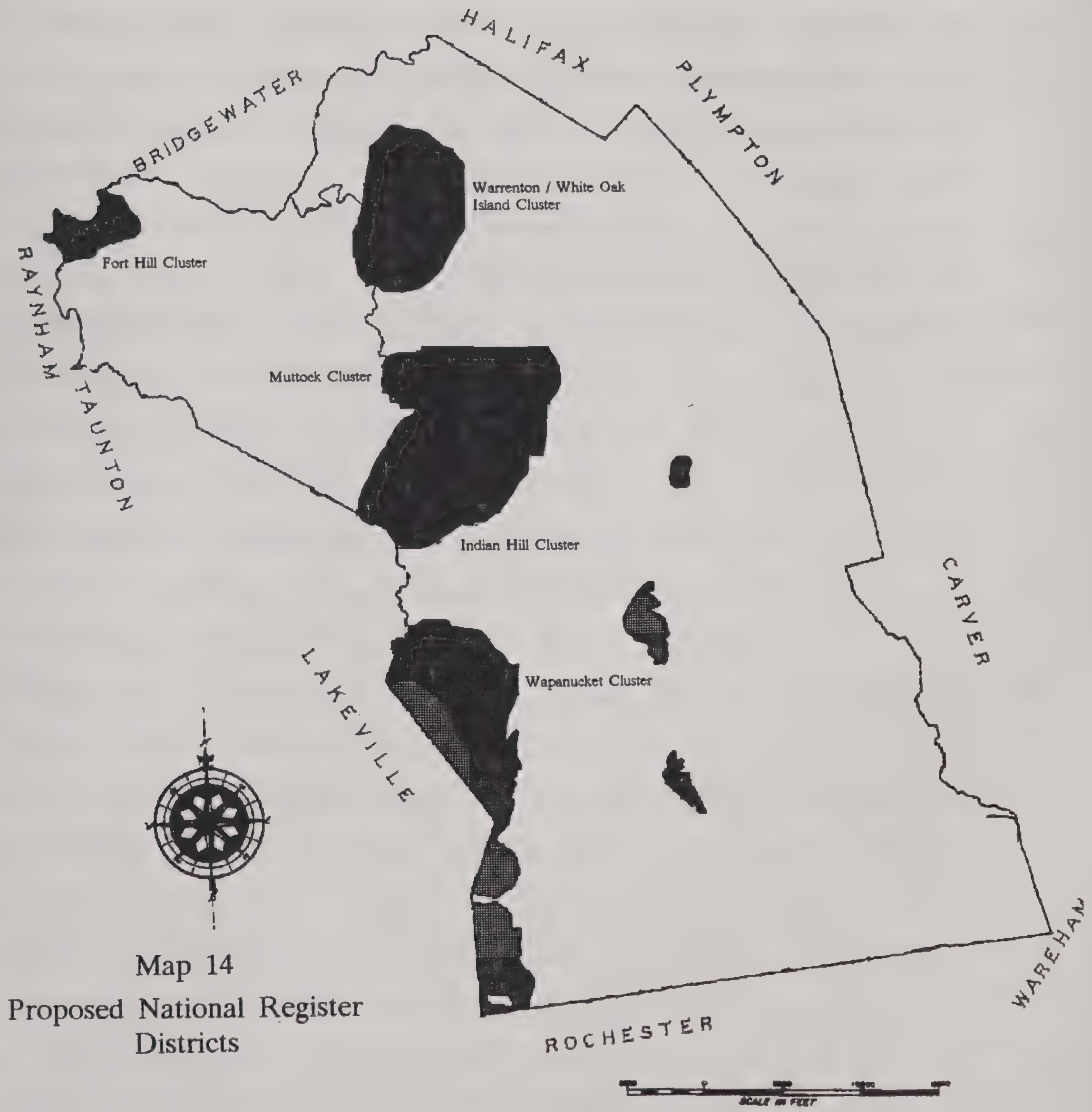
2. It is associated with the lives of persons significant in our past; or

3. It embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic value, or represents a significant and distinguishable entity whose components may lack individual distinction; or

4. it has yielded, or may be likely to yield, information important in prehistory or history. (Talmage, Orfant, and Durfee 1979)

Normally, prehistoric archaeological sites do not qualify under criterion 2, but credible arguments may be made for inclusion under criteria 1 and 3 (as distinctive or typical), and all prehistoric sites regardless of their size, complexity, or intensity are capable of being nominated on the basis of criterion 4. Nominations which combine criteria are likely to be more acceptable, since they will stand even if one criterion is disallowed in the particular case.

In addition to the basic significance criteria, the National Register has established frames of reference for their application at the local, regional, and national levels. Thus, a Middle Archaic site could be nominated at the local level (though not at the regional or national levels) under criteria 1 and/or 3 even if there were other Middle Archaic sites on the Register in adjacent towns. This means that criteria 1 and 3 can be used to preserve one example of each phase of prehistory, or each site function. This could produce a total of about 20 potential nominations, even without relying on criterion 4.



Map 14
Proposed National Register Districts

Finally, the Register allows for the nomination of districts as well as individual sites. There are two major advantages of district nominations over individual site nominations. First, a district nomination may include sites whose boundaries are not well defined, and even sites which have not yet been discovered. Second, if the district includes 50 or more landowners it is unneccessary to obtain the permission of each owner prior to nominating the district; notice of a public meeting is sufficient for this purpose. National Register Districts are an essential planning tool in conserving important archaeological sites, in that they place the imprimatur of Federal recognition on the district, ensure that any public lands or lands where public funds are expended are subjected to a thorough archaeological review process prior to any construction, and in a general way encourage the conservation of the contributing elements in perpetuity. It will not prevent development, however, especially on strictly private lands where no public funds are involved.

At the current time, the Principal Investigator suggests that the Middleborough Historical Commission consider nominating as districts the five site clusters at Fort Hill, Warrentown-White Oak Island, Muttock, Indian Hill, and the area between Assawompsett Pond and Fall Brook (see Map 14). It might be possible to expand the existing National Register listing for Wapanucket into a district nomination for the latter cluster. This might be expanded in cooperation with the Town of Lakeville to include the sites on the opposite side of the Nemasket River. The Town should also consider a joint nomination with the Town of Bridgewater for the Titicut and Seaver Farm sites on the opposite bank of the Taunton River from Fort Hill. It is possible that, since most of the sites in the Warrentown-White Oak Island cluster have been damaged or destroyed, it might be better simply to nominate the base camp, MBO 15, rather

than the entire district. Field testing of the model will help to determine this. Other than these five districts, it may be appropriate to nominate some individual sites to the register. For these, permission of the owner(s) would be required. Specific sites which most merit nomination, on the basis of research potential, include MBO 21, 24, 48, 61, 74, 76, 85, and 101.

C. Cultural Resource Protection By-Laws:

The Town may wish to consider creating a zoning ordinance or by-law which would have the force of protecting significant cultural resources in known areas, or at least requiring that archaeological surveys and other appropriate measures be undertaken prior to any construction in these areas. This would apply most particularly to those sites which are too isolated from clusters to be included in National Register Districts, and where site integrity is still reasonably good. This might be politically difficult, since it would potentially involve either disclosure of specific site locations before Town Meeting or convincing Town Meeting members that the Historical Commission ought to be given the authority to designate sites without public disclosure. However, if tax abatements are included for landowners who agree to conservation easements so as to protect the sites on their lands, this might not be a political impossibility. This kind of by-law could also be very useful in the event that large scale outside developments are proposed, such as the proposal to site an international airport in Middleborough. The presence of archaeological resources would be one more factor that a developer would be required to deal with, and it might be enough on balance to discourage unwise development.

D. Long-Term Monitoring:

It should be understood by the Town that the present inventory represents only a sample of the sites in Middleborough, and that additional sites, and additional artifacts from known sites, will continue to be discovered. This may occur in any of four ways. First, collectors who did not participate in the current inventory may be be encouraged by its results to come forward with their collections. This could potentially add a great deal of information. Second, future cultural resource management projects in the town are likely to encounter unknown sites. Of the eight such surveys already undertaken in Middleborough, only one (Pagoulatos 1987) failed to find prehistoric cultural material. Third, the Massachusetts Archaeological Society, in particular the Cohannet Chapter of the Society, is interested in returning to work in Middleborough in the future. Since the Society's headquarters are now located in town this is a natural outgrowth of local interest in the Society and the Robbins Museum. Finally, chance finds by residents in their gardens, fields, and cranberry bogs are sure to continue.

In order to deal with the ongoing accumulation of data, the following measures are recommended:

1) The Middleborough Historical Commission should stipulate that all cultural resource managers planning to work within the Town under permit from the State Archaeologist agree to forward one copy of the final survey report to the Commission. Now that the Freedom of Information problem is solved, there should be no legal barrier to prevent this. The Commission could also, if it wished, further stipulate that all cultural material

retrieved from such surveys be curated within the Town, assuming that the Robbins Museum is willing to agree to serve as the repository. The Town of Westborough has established this type of relationship with cultural resource management firms and M.H.C., and could be used as a model;

2) The Commission should require that prospective survey teams familiarize themselves with the current model, and provide in their final report information which could easily contribute to it. The M.H.C. archaeological survey inventory form (Form D) already contains blanks for most of the parameters used in this inventory (with the exception of hypsometric integral, stream rank, and aspect), but submitters are very inconsistent in the thoroughness with which they fill out this form, and, in some cases, what sites they consider significant enough to file. Several surveys recovered cultural materials from Middleborough sites and filed site reports, but failed to file inventory forms for the sites discovered (Pagoulatos and Leveillee 1988, Gorman and Dalton 1986, Holstein 1988). The Middleborough Historical Commission should develop a close relationship with M.H.C., and should request the opportunity to comment on survey reports done on locations within the town as a regular part of M.H.C.'s review process. If a draft report does not provide the requisite information, the Commission should advise M.H.C. of this deficiency. M.H.C. has the authority to require submitters to make revisions in draft reports prior to their final submission. In cases where the survey is performed for private developers where a permit from the State Archaeologist is not required, the Town should also require copies of final reports, and should have similar rights of review and emendation, at the survey team's expense;

3) The Commission should consider submitting, as a line item in its annual budget each year, an appropriation to cover the costs of continuing the inventory of artifacts and sites. This does not need to be a very large sum, so long as it is enough to cover the cost of photographic film and developing and the personnel cost of having a knowledgeable person or persons enter the data. An estimate of $1000 for the first year would probably be sufficient, and estimates for future years could be based upon actual expenses against this amount;

4) Through the use of appropriate publicity about the current project and its achievements, the Commission and the Committee could help to encourage collectors and others to come forward with their materials. This could include some of the participants in the Wapanucket excavation who retained large collections and were not contacted because of the relatively higher priority placed on discovering new sites by the inventory team. This would be particularly helpful if some of the early excavators participated, since the inventory for Wapanucket 1-5 is more deficient that for Wapanucket 6 or 8.

E. <u>Other Recommended Measures</u>:

Another strategy which the Town might undertake is a program of land acquisition for the in-ground preservation of prehistoric sites. The Town already owns some lands on which sites are located, and most of the sites adjacent to the Lakeville ponds are controlled by the New Bedford Water Department. The Rocky Gutter area, though it has produced few sites, is protected by the State Division of Fisheries and Wildlife. An active program of site survey within these public parcels is recommended, provided the public

agencies are able to fund it. Such a study is already underway in the Lakeville ponds area (Elia 1990). The Town should monitor these efforts carefully, as well as any long-range plans which New Bedford or the Commonwealth of Massachusetts may develop for the use of their lands, and argue forcefully for adequate survey in the event that these plans involve potential destruction of sites.

There are, in addition, a number of non-profit organizations such as Trustees of Reservations and Plymouth County Wildlands Trust which serve as land trusts. These groups purchase properties of interest to them and create permanent conservation zones on them. At the very least, the Town should refrain from disposing of any of its lands to private development without demanding that archaeological survey be done prior to construction.

In addition, Town officials could advocate for increased authority on the state level over developments on private lands where environmental impact reports are required. Legislation which would grant broader jurisdiction to M.H.C. and would establish local historic district commissions has gradually been gaining State House support over the past three years. It should be noted that the M.E.P.A. Unit of the Department of Environmental Protection has an inconsistent record of informing M.H.C. of forthcoming projects that could affect prehistoric resources.

The Town should also make use of the inventory and accompanying map to designate areas of expected cultural sensitivity (see Map 3). These could be used as leverage to encourage developers to conduct surveys in cases where no Federal or state laws currently require them to do so. Tax abatements and careful control over proposed zoning changes could be used as a carrot-and-stick approach in these cases.

The recommendation made above concerning cooperation with adjacent towns in drafting National Register nominations could be expanded to include promoting similar inventories in neighboring communities. Since the present political boundaries of Middleborough do not correspond to any known cultural boundaries in prehistoric times, the cultural manifestations documented herein would be expected to spill over into adjacent towns, as indeed the 1980 and 1984 studies by Thorbahn (et al.) indicate. For example, the Transitional Archaic ceremonial complex so prominent in Middleborough is also documented from sites in Bridgewater, Raynham, Wareham, Lakeville, and Rochester (Hoffman 1989a). Any information derived from the adjacent towns would certainly help archaeologists to better understand the lifeways of the prehistoric inhabitants of Middleborough.

Finally, a most important long-term strategy involves the use of the inventory material (while protecting specific site locations) as an educational tool for both children and adults. This could have the effect of encouraging an appreciation of Middleborough's rich and varied prehistory, its sensitivity to any ground-moving activities, and a greater public voice in preserving these resources. This should most certainly include participation by the modern descendants of the prehistoric peoples who once lived in Middleborough. The principal investigator is convinced that only an attitudinal change on the part of local citizens will be sufficient to ensure the long-term preservation of the cultural resources in the town. To this end, the Robbins Museum of Archaeology is planning several programs, and these should be closely integrated with town agencies.

Appendix A

LIMITATIONS OF THE DATA

Several crucial factors must be taken into account when evaluating the data. Bias may have been introduced into the data set from many different directions, and while some of these may have the effect of cancelling each other out, responsible research demands the explicit delineation of potential problem areas.

1. Data Collection:

First, it should be made clear that the artifacts inventoried represent only a sample of the total left behind by the prehistoric inhabitants of Middleborough. There is no way of knowing quantitatively what percent sample they represent. One measure of sample size may be the fact that Robbins' report on the Wapanucket sites (1981) details the recovery of over 14,000 artifacts, of which fewer than 17.5% have so far been inventoried during this project. Several large collections and many smaller ones known to members of the Middleborough Historical Commission were unavailable for study, for a variety of reasons. These included time constraints, problems with estates, personal family problems, and suspicions on the part of the owners about the nature and goals of the survey. The individual members of the Commission are to be commended for their tireless efforts in contacting collectors (in some cases over and over again), for without these efforts the inventory would have been much poorer and less representative. However, the absence of certain key collections (in particular, those of active members of the Middleborough Anthropological Association such as Joseph Prenzo) has detracted from the comprehensiveness of the survey. Although Prenzo's map of site locations in the

Middleborough area was made available to the survey, and although some collectors pointed out sites they knew of on the U.S.G.S. map, sites were not recorded unless actual artifacts were presented to us, because we could not verify them as sites. According to Phillip Brady, who provided us with the map, some of the symbols on it indicated places where Prenzo thought might be good site locations, without any tangible evidence. In a locational survey of this type, this was clearly insufficient for inclusion. It should also be noted that four sites (19PL156, 19PL201, 19PL219, and 19PL292) recorded in M.A.S. and M.H.C. inventories also produced no artifacts observed during the current inventory, and they are therefore not included in it, for the same reason. These were reported to the M.A.S. by collectors in the 1940's and 1950's and were copied uncritically into M.H.C. inventories. In only two cases were artifacts included which were not viewed directly by the survey team. These were the Ray Seamans Jr. collection, which was reasonably well inventoried by Thomas Mahlstedt (1985), and a single artifact recovered from the Orange Cat site by the Public Archaeology Laboratory, Inc. (Holstein 1988), which was not made available for inventorying along with other artifacts obtained by P.A.L. during their cultural resource management operations in the town. In both cases, the sites were already on file at M.H.C. The inventories in Robbins' Wapanucket volume were largely based upon the older M.A.S. typology, and were only used to establish the presence/absence of certain site functions (specifically, ceremonialism, food storage, and trade) where we had not inventoried specific artifacts of the types discussed therein.

Second, the goal of the project -- the accurate recording of site locations in town so as to provide information useful to constructing a model of prehistoric land use patterns -- precluded the use of any artifacts whose site

provenience could not be established beyond a reasonable doubt. In some cases, entire large collections had to be rejected for this reason. In other cases (including artifacts attributed to the Wapanucket for which matching record cards could not be found) the unprovenienced portions of collections were not inventoried. It should be noted that, with few exceptions, the artifacts deriving from surface locations were accompanied by no documentation other than that which their collectors could recall. Consequently, another source of bias is the possibility that collectors remembered which artifacts came from which sites inaccurately, or even misrepresented them. The information given by collectors was taken at face value, and no attempt was made to verify its accuracy independently. In cases where several collectors had materials from the same site, it was possible to compare samples to see whether they corresponded in terms of tool types and lithic frequencies. In at least one case, MBO 61, there was practically no overlap between two moderate-sized collections represented as being from the same site. Either there was some intentional or unintentional misrepresentation taking place, or perhaps the collections derived from spatially separate locations at the site containing quite different temporal components.

It is also possible that site locations were inaccurately reported. Russell Barber and Laurel Casjens (1978) reported a persistent tendency for sites in the lower Merrimack Valley to be mislocated by about 1/4 mile from their true locations in M.A.S. site files. This was presumably done by those who reported them so as to distract potential looters from the sites. As with the attribution of artifacts, no independent verification of site locations was undertaken. This problem could have biased the inventory very seriously, both in terms of the correct identification of environmental variables and the nearest

neighbor analysis. Even when documentary information on provenience was available, it was not always accurate or verifiable as to source. For example, William Greene kept a notebook of his finds from 1935-39 which was obtained along with a substantial portion of his collection by a collector in the 1970s. It was possible to make 1:1 matches of many artifacts with his excellent line drawings, but his description of site locations leaves much to be desired, and some artifacts simply could not be traced to specific locations, even when these would have filled in substantial gaps in the map.

A third problem involves the biases introduced by the collectors at the time of field collection. Most untrained individuals can readily recognize projectile points, axes, and celts as being products of prehistoric manufacture, but this does not so often apply to many of the humbler items of a typical prehistoric tool kit. Cores, utilized flakes, preforms, and casual tools in general often escaped detection. This is readily observable by comparing almost any of the larger surface-collected assemblages with the materials collected from a controlled excavation. Even the Wapanucket assemblage is relatively lacking in such items. With the exception of the last few seasons at Wapanucket, debitage was not normally collected, so that casual flake tools often were discarded. Thus, even in some controlled situations the thoroughness of data collection is likely to have been uneven. Some collectors did present the survey team with quantities of lithic material which included many casual tools and pieces of debitage, but they were in the minority.

Biases of this sort also apply to lithic material. It has long been recognized that worked quartz is easier to spot on the surface of plowed fields because of its color and luster; this is casually referred to as the "quartz recognition factor". By contrast, some collectors have actively eschewed the

collection of quartz artifacts. These types of biases are likely to have skewed the distribution of lithics in collections. It was because of this problem that it was decided not to include a formal analysis of lithic material distributions in the model, since the bias in this area was expected to be so extreme. Only exotic materials probably deriving from outside southeastern Massachusetts altogether were studied. Pottery is also very likely underrepresented in the model, in part because New England prehistoric pottery is very friable and not very aesthetically pleasing to Western eyes.

2. Interpretation:

In addition to the above problems of sampling accuracy, biases may have been introduced by the survey team in the course of recording the data. Typological identifications and attributions of lithic materials may in some cases be incorrect, although when questions arose the survey team usually consulted the principal investigator. A review of the slides along with the record cards disclosed several errors. Every effort has been made to correct all of these prior to performing calculations. However, it is certainly possible that some mistaken identifications slipped through. There is furthermore an unaccountable residue of about 25 artifacts for which there are either slides but no cards, or cards but no slides.

It is also possible that errors of interpretation have been introduced by the principal investigator. Typological studies in New England are at a critical juncture, at which there is general agreement among most archaeologists as to the major delineation of styles through prehistory, but there is often considerable overlap between similar styles and identification is more qualitative than quantitative in nature. No one has performed the complex

multivariate statistical tests on a significantly large body of data from southern New England to establish quantitative parameters for types. Consequently, it is entirely possible for any individual researcher to mistype artifacts, and this can result in misunderstandings of site age and function. This problem is addressed in some detail in both the M.H.C. and new M.A.S. typology manuals (Johnson and Mahlstedt 1984, Hoffman 1991a). One of the long-term goals of the inventory project is to establish a data base from which a quantitative typology might be developed, and it was for this reason that metric measurements were recorded for each artifact. However, to perform the necessary calculations would have been well beyond the scope of this initial project, and the sample size is still really too small for reliable statistics to be performed (one would ideally want at least 30 specimens of each type).

Finally, it is also possible, though less likely, that the general consensus about the changes of artifact style through prehistory is itself wrong in some of its details. Continual discussion, both in print and at conferences, is taking place in an attempt to refine our models of prehistoric stylistic change. That this should be the case may disturb non-scientists, but it should not be surprising to anyone familiar with the scientific method -- especially since scientific archaeology is a relatively recent endeavor. Planners using this document should recall that it presents a <u>model</u> of prehistoric land use patterns, which is not necessarily the same thing as the absolute <u>truth</u> about those patterns. It is simply the best approximation to the truth that was possible under the conditions described above.

Appendix B

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(Note: BMAS = Bulletin of the Massachusetts Archaeological Society)

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Appendix C

Tables
(Tables 1-6 in back pocket)

TABLE SEVEN
OTHER TOOLS FROM MIDDLEBOROUGH SITES

SITE NAME	BONE AWL	BONE FLAKER	CERAMIC VESSL	GRTTEMP SHERD	SHLTEMP SHERD	CERAMIC PIPE	STONE PIPE	STEATITE VESSL	STEATITE FRAG	SHELL PENDANT	CLAY CONCRETN	WOODEN BOWL	TOTAL
MBO 21								1					1
MBO 25								1					1
MBO 49									1				1
MBO 61	1												1
MBO 62				10	6				5				21
MBO 117									1				1
19PL148			1						1				2
19PL163		1											1
19PL165	5									2			7
19PL203-5								1					1
19PL203-6	1					1		1				1	4
19PL203-8	1						1		1		4		7
19PL291				1									1
	8	1	1	11	6	1	1	4	9	2	4	1	49

TABLE 8
ASPECT CORRELATIONS

SITE AGE

	PI	EA	MA	LA	TA	EW	MW	LW	CO	UN	TOTAL
E			1	2	2	3	1		1	13	23
NE				1			1	1		7	10
N		1	5	7	8	6	3	4		12	46
NW	2	2	6	8	6	5	2	3	2	6	42
W	1	2	3	7	3	3	2	4	1	18	44
SW	1	2	3	6	4	3	4	6		17	46
S	1	5	7	16	7	10	7	8	4	8	73
SE	1	2	5	7	5	6	4	5		6	41
TOTAL	6	14	30	54	35	36	24	31	8	87	325

SITE FUNCTION

	CE	CP	FI	FP	FS	HO	HU	TM	TR	WW	TOT.
E	1		3	7			7	10	1	1	30
NE				1	1		3	4		1	10
N	3	4		11	1		10	14	3	3	49
NW	2	2		8			8	8	3		31
W	2	2	3	7			8	14	2	4	42
SW	2	4	2	11	2	1	7	21	3	1	54
S	5	7	7	14	6	2	15	13	11	5	85
SE	2	4	2	9	2	2	8	8	6	3	46
TOTAL	17	23	17	68	12	5	66	92	26	18	344

COMPLEXITY

	1	2	3	4	5	6	8	9	10	TOT.
E	13	4	3							20
NE	10	1								11
N	12	4	2	2	1		1			22
NW	7	2	1	3		1				14
W	21	2	1			1	1			26
SW	14	5		4		1		1		25
S	9	5	2	3	2	3		1	1	26
SE	7	3	1	2	1		1		1	16
TOTAL	93	26	10	14	4	6	3	2	2	160

REDUNDANCY

	1	2	3	4	5	6	7	8	9	TOT.
E	6			1						7
NE	3									3
N	3	2		1	2	1	1			10
NW	1	2			1	2		2		8
W	4	1		1			1		1	8
SW	2	2	1		1		1	1		8
S	6	2	3		2	3	3			19
SE	4	2				2	1	1		10
TOTAL	29	11	4	3	6	8	7	4	1	73

INTENSITY

	1-2	3-5	6-10	11-15	16-20	21-30	31-50	51-100	>100	TOT.
E	4	1	1			1				7
NE	3									3
N	3	3	2	1			1			10
NW	4	2			1	1				8
W	2	2	2			1	1			8
SW	1	1	2	2		1		1		8
S	5	5	2	3	2		1			18
SE	3	5				1			1	10
TOTAL	25	19	9	6	3	5	3	1	1	72

TABLE 9
PROXIMITY TO WATER CORRELATIONS

SITE AGE

	PI	EA	MA	LA	TA	EW	MW	LW	CO	UN	TOT.
< 25	1	1	1	2	1	1	1	2		6	16
25			1	5	4	2	2	1		8	23
50	1	6	8	11	7	10	8	8	5	7	71
75	1	2	6	9	5	6	3	2		7	41
100			3	4	1	2	1	1		6	18
125	1	2	4	5	4	5	3	3	1	5	33
150	2	2	3	7	4	4	3	5	1	6	37
175		1	1	2	2	1	1	1	1	4	14
200				2	1					3	6
250			2	4	2	2	1	3		7	21
300				1				3		6	10
400			1	2	2	2		1		6	14
500										7	7
600					1	1				1	3
700										4	4
>700					1		1	1		4	7
TOT.	6	14	30	54	35	36	24	31	8	87	325

SITE FUNCTION

	CE	CP	FI	FP	FS	HO	HU	TM	TR	WW	TOT.
< 25	1			1			2	7			11
25		2	3	7	1		6	6	3	2	30
50	7	8	6	12	6	3	12	13	11	6	84
75		2	3	9	1	1	9	11	2	2	40
100	2	3		5	1		5	7	2	1	26
125	1	2		6	1		8	6	4	1	29
150	3	4	2	7			7	9	3	1	36
175			1	2			3	5	1	1	13
200	1			2			2	2			7
250		1	2	4		1	4	5	1	2	20
300					1		3	4	1	2	11
400		1		3			3	7			14
500	1			4				5			10
600				1	1		1	1	1		5
700				4				2			6
>700	1			1			1	2			5
TOT.	17	23	17	68	12	5	66	92	29	18	347

COMPLEXITY

	1	2	3	4	5	6	8	9	10	TOT.
< 25	8			2						10
25	6	6		1	1					14
50	8	2		2	2	4		1	2	21
75	9	1	4	2				1		17
100	7	2		3			1			13
125	7	2	1	1		1				12
150	7		1	3		1	1			13
175	4	1	1	1						7
200	3	2								5
250	9			1			1			11
300	8		1							9
400	6	2		1						9
500	4	3								7
600	1	2								3
700	2	2								4
>700	4	1								5
TOT.	93	26	8	17	3	6	3	2	2	160

TABLE 9 (CONTINUED)
PROXIMITY TO WATER CORRELATIONS

REDUNDANCY

	1	2	3	4	5	6	7	8	9	TOT.
< 25	1	1				2				4
25	5			1						6
50	3	1	2		1	2	3	2		14
75	3	2		2		1	1	1		10
100	2	2				1				5
125	4				2		2			8
150	2	1			1	1	1		1	7
175	2							1		3
200	1	1								2
250	1	1			1	1				4
300	2	1								3
400	1	1			1					3
600	2									2
>700			1							1
TOT.	29	11	3	3	6	8	7	4	1	72

INTENSITY

	1-2	3-5	6-10	11-15	16-20	21-30	31-50	51-100	>100	TOT.
< 25		4								4
25	3	1	2							6
50	2	2	3	2	3		1		1	14
75	4	1	2			2	1			10
100	2	1	1	1						5
125	4	2	1					1		8
150	1	3		1		1	1			7
175		2				1				3
200	1	1								2
250	2	1				1				4
300	1			2						3
400	2	1								3
600	2									2
>700	1									1
TOT.	25	19	9	6	3	5	3	1	1	72

TABLE 10
HYPSOMETRIC INTEGRAL CORRELATIONS

SITE AGE

	PI	EA	MA	LA	TA	EW	MW	LW	CO	UN	TOT.
<.15			1	2	1	1	1			3	9
.15-.20	1	3	5	10	7	5	4	3	2	9	49
.21-.25		2	2	2	2	2	2	2	1	2	17
.31-.35			1	4	2	1	1	1		3	13
.36-.40	2	3	6	6	5	5	5	5		8	45
.41-.45	1	6	8	14	7	12	8	9	4	2	71
.46-.50			2	1	1	1	1	1		4	11
.51-.55	2		2	5	2	2		2		8	23
.56-.60			1	4	3	2	2	5		13	30
.61-.65				1	1	1			1	11	15
.66-.70										4	4
>.70					1					2	3
TOTAL	6	14	28	49	32	32	24	28	8	69	290

SITE FUNCTION

	CE	CP	FI	FP	FS	HO	HU	TM	TR	WW	TOT.
<.15		1		2			3	4			10
.15-.20	2	3	4	11			10	14	4	3	51
.21-.25	1	2	1	2			2	4	2		14
.31-.35	3	2	1	6			4	2	1	1	20
.36-.40	2	4	1	7	1	1	8	9	4	4	41
.41-.45	4	8	6	13	7	3	14	11	11	5	82
.46-.50	2	1		2	1		2	5	1	1	15
.51-.55	1			7			5	5	1	1	20
.56-.60	1	1	1	4	1	1	8	9	2	3	31
.61-.65	1		1	5			4	8	1		20
.66-.70				4				1			5
>.70				1	1			2	1		5
TOTAL	17	22	15	64	11	5	60	74	28	18	314

COMPLEXITY

	1	2	3	4	5	6	8	9	10	TOT.
<.15	2	1	2							5
.15-.20	8	4	3	3		1	1			20
.21-.25	2					2				4
.31-.35	2	3		3						8
.36-.40	10	2		2	2			1		17
.41-.45	3	1		5	2	3		1	2	17
.46-.50	4		1				1			6
.51-.55	9	3	1	1						14
.56-.60	15	2	1				1			19
.61-.65	11	4	1							16
.66-.70	3	1								4
>.70	1	2								3
TOTAL	70	23	9	14	4	6	3	2	2	133

TABLE 10 (CONTINUED)
HYPSOMETRIC INTEGRAL CORRELATIONS

	REDUNDANCY									
	1	2	3	4	5	6	7	8	9	TOT.
<.15		1		1						2
.15-.20	4	2		1		1	1	1	1	11
.21-.25							1	1		2
.31-.35	3	1			1					5
.36-.40	3	1		1		1	2	1		9
.41-.45	2	2	2		2	3	3	1		15
.46-.50	1					1				2
.51-.55	2	1			1	1				5
.56-.60	2	3	1			1				7
.61-.65	4									4
>.70	1									1
TOTAL	22	11	3	3	4	8	7	4	1	63

	INTENSITY									
	1-2	3-5	6-10	11-15	16-20	21-30	31-50	51-100	>100	TOT.
<.15			1				1			2
.15-.20	4	1	5				1			11
.21-.25					1	1				2
.31-.35	1	3		1						5
.36-.40	2	4	1			2				9
.41-.45	3	3	2	2	2		1	1	1	15
.46-.50	1			1						2
.51-.55	2	3								5
.56-.60	4	2				1				7
.61-.65	2	1				1				4
>.70	1									1
TOTAL	20	17	9	4	3	5	3	1	1	63

TABLE 11
STREAM RANK CORRELATIONS

SITE AGE

	PI	EA	MA	LA	TA	EW	MW	LW	CO	UN	TOT.
1	1	1	6	14	9	8	4	8		49	100
2	2	6	8	16	7	11	8	9	5	13	85
3	1	1	2	2	3	2	2	2		4	19
4	1	1	5	6	3	4	2	4		9	35
5				1	1	1	1	1		1	6
6-10		1	3	5	3	3	1	2		5	23
11-15		1	1	2	2	1	1	1		4	13
16-20	1	3	5	7	6	5	4	3	3	2	39
>20				1	1	1	1	1			5
TOT.	6	14	30	54	35	36	24	31	8	87	325

SITE FUNCTION

	CE	CP	FI	FP	FS	HO	HU	TM	TR	WW	TOT.
1	2	7	4	27	2	1	17	50	5	3	118
2	5	6	8	14	7	3	19	12	12	6	92
3		2	1	3	1	1	3	6	3	2	22
4	4	1		10	2		9	6	4	2	38
5	1		1	1			2				5
6-10		1	1	3			5	7	1	3	21
11-15	1	1		2			3	4	1	1	13
16-20	3	4	2	7			7	7	3	1	34
>20	1	1		1			1				4
TOT.	17	23	17	68	12	5	66	92	29	18	347

COMPLEXITY

	1	2	3	4	5	6	8	9	10	TOT.
1	50	16	1	4		2	1			74
2	18	4		5	2	2		1	2	34
3	4			1	1			1		7
4	8	2	5	1			1			17
5	1	2								3
6-10	7		2			1				10
11-15	3	1			1					5
16-20	1	1	3	2		1	1			9
>20				1						1
TOT.	92	26	11	14	4	6	3	2	2	160

REDUNDANCY

	1	2	3	4	5	6	7	8	9	TOT.
1	13	1	1	1	2	2	1			21
2	8	3	2		1	3	3	1		21
3	1					1		1		3
4	2	3			1	1	1			8
5	1			1						2
6-10	2	2			1		1			6
11-15	2						1			3
16-20		2		1		1		2	1	7
>20					1					1
TOT.	29	11	3	3	6	8	7	4	1	72

TABLE 11 (CONTINUED)
STREAM RANK CORRELATIONS

	INTENSITY									
	1-2	3-5	6-10	11-15	16-20	21-30	31-50	51-100	>100	TOT.
1	11	3		2		4		1		21
2	5	8	2	2	2		1		1	21
3		1	1			1				3
4	2	4		2						8
5			2							2
6-10	3		2				1			6
11-15	2	1								3
16-20	2	1	2		1		1			7
>20		1								1
TOT.	25	19	9	6	3	5	3	1	1	72

TABLE 12
SOIL CORRELATIONS

SITE AGE

	PI	EA	MA	LA	TA	EW	MW	LW	CO	UN	TOTAL
BIRDSALL				1							1
SACO			1	1	1	1	1	1		4	10
SCARBORO				3	1	1				3	8
RAYNHAM		1	2	1	1	1	1	1			8
WAREHAM		1	1	1	1	1	1	1	1	1	9
NORWELL				1	1	1	1	1			5
BELGRADE			1	1						1	3
DEERFIELD					2		1	1		1	5
SCITUATE										1	1
AGAWAM	1	1	2	3	3	3	2	1	1	2	19
ESSEX			2	3	3	3		2	1	6	20
MERRIMAC	1	1	3	7	5	4	3	4	1	6	35
GLOUCESTER			2	4	1	1	1	3		31	43
HINCKLEY	1	1	3	4	5	3	2	4		15	38
WINDSOR	3	9	12	20	10	15	11	11	4	13	108
CARVER			1	4	1	1		1		2	10
UNCLASS.						1				1	2
TOTAL	6	14	30	54	35	36	24	31	8	87	325

SITE FUNCTION

	CE	CP	FI	FP	FS	HO	HU	TM	TR	WW	TOT.
BIRDSALL				1			1			1	3
SACO		1	1	2			1	2	1	2	10
SCARBORO	1		1	2			4	2			10
RAYNHAM	1			2			2	1	1		7
WAREHAM				1			1	2	1		5
NORWELL	1	1		1			1				4
BELGRADE				1			1	2			4
DEERFIELD	1		1				1		1	1	5
SCITUATE				1				1			2
AGAWAM	1	2	1	3			4	4	1	1	17
ESSEX	1			2			5	4	1	1	14
MERRIMAC	3	3	1	8	1		9	7	4		36
GLOUCESTER		3	3	15		1	4	32	1	1	60
HINCKLEY	2	1	1	6	3		7	14	4	1	39
WINDSOR	6	11	8	20	7	4	20	19	14	10	119
CARVER		1		2	1		4	2			10
UNCLASS.				1			1				2
TOTAL	17	23	17	68	12	5	66	92	29	18	347

COMPLEXITY

	1	2	3	4	5	6	8	9	10	TOT.
BIRDSALL			1							1
SACO	3	1			1					5
SCARBORO	6	2								8
RAYNHAM			1	1						2
WAREHAM	1			1						2
NORWELL				1						1
BELGRADE	1		1							2
DEERFIELD	1	2								3
SCITUATE		1								1
AGAWAM	1	1	2				1			5
ESSEX	8	3								11
MERRIMAC	10	1		3		2				16
GLOUCESTER	26	6	1	3			1			37
HINCKLEY	15	4	2	1			1			23
WINDSOR	15	4	1	4	3	4		2	2	35
CARVER	4	1		1						6
UNCLASS.	2									2
TOTAL	93	26	9	15	4	6	3	2	2	160

TABLE 12 (CONTINUED)
SOIL CORRELATIONS

REDUNDANCY

	1	2	3	4	5	6	7	8	9	TOT.
BIRDSALL	1									1
SACO						1				1
SCARBORO	5									5
RAYNHAM	1						1			2
WAREHAM								1		1
NORWELL					1					1
BELGRADE		1								1
DEERFIELD	1		1							2
AGAWAM				1		1			1	3
ESSEX	2	1		1	1					5
MERRIMAC	4	3			1	1		1		10
GLOUCESTER	2	2				1				5
HINCKLEY	4	1			1	1	1			8
WINDSOR	5	3	2	1	1	3	5	2		22
CARVER	3				1					4
UNCLASS.	1									1
TOTAL	29	11	3	3	6	8	7	4	1	72

INTENSITY

	1-2	3-5	6-10	11-15	16-20	21-30	31-50	51-100	>100	TOT.
BIRDSALL			1							1
SACO		1								1
SCARBORO	3	2								5
RAYNHAM	1	1								2
WAREHAM		1								1
NORWELL		1								1
BELGRADE							1			1
DEERFIELD	2									2
AGAWAM	1		1				1			3
ESSEX	5									5
MERRIMAC	5	1	2		1			1		10
GLOUCESTER		1		2		2				5
HINCKLEY	2	1	2	2		1				8
WINDSOR	4	7	3	2	2	2	1		1	22
CARVER	1	3								4
UNCLASS.	1									1
TOTAL	25	19	9	6	3	5	3	1	1	72

TABLE 13
SLOPE CORRELATIONS

SITE AGE

	PI	EA	MA	LA	TA	EW	MW	LW	CO	UN	TOT.
0-5	5	9	20	34	18	24	13	15	6	66	210
5-15	1	5	10	18	16	12	11	15	2	18	108
15-25				2	1			1		3	7
TOT.	6	14	30	54	35	36	24	31	8	87	325

SITE FUNCTION

	CE	CP	FI	FP	FS	HO	HU	TM	TR	WW	TOT.
0-5	11	14	12	48	8	4	42	66	18	10	233
5-15	6	9	4	19	3	1	21	23	10	8	104
15-25			1	1	1		3	3	1		10
TOT.	17	23	17	68	12	5	66	92	29	18	347

COMPLEXITY

	1	2	3	4	5	6	8	9	10	TOT.
0-5	67	19	6	13	2	3	2	2	2	116
5-15	22	7	2	2	2	3	1			39
15-25	4		1							5
TOT.	93	26	9	15	4	6	3	2	2	160

REDUNDANCY

	1	2	3	4	5	6	7	8	9	TOT.
0-5	18	9	3	3	2	6	4	3	1	49
5-15	10	1			4	2	3	1		21
15-25	1	1								2
TOT.	29	11	3	3	6	8	7	4	1	72

INTENSITY

	1-2	3-5	6-10	11-15	16-20	21-30	31-50	51-100	>100	TOT.
0-5	18	11	6	4	2	4	3		1	49
5-15	6	8	3	1	1	1		1		21
15-25	1			1						2
TOT.	25	19	9	6	3	5	3	1	1	72

TABLE 14
NEAREST NEIGHBOR CORRELATIONS

COMPLEXITY

	1	2	3	4	5	6	8	9	10	TOT
<100	4			1		1				6
100-200	20	5	3	5	1		1	1	1	37
200-300	14	5	3	2	1	4	1			30
300-400	8	4		3					1	16
400-500	4	1	1	1			1			8
500-600	15	1		1	1	1		1		20
600-800	6	2	1	1						10
800-1000	11	3		2						16
1000-1500	6	4	1							11
>1500	4	1								5
TOTAL	92	26	9	16	3	6	3	2	2	159

REDUNDANCY

	1	2	3	4	5	6	7	8	9	TOT
<100		1				1				2
100-200	3	2	2	2	3	2	3			17
200-300	9	2			1		3	2	1	18
300-400	2		1	1	1		2	1		8
400-500	2					1				3
500-600	5	1				2		1		9
600-800	3	3								6
800-1000	3	1			2					6
1000-1500	2	1								3
TOTAL	29	11	3	3	7	6	8	4	1	72

INTENSITY

	1-2	3-5	6-10	11-15	16-20	21-30	31-50	51-100	>100	TOT
<100		1			1					2
100-200	3	5	4	4			1			17
200-300	7	3	3	1	1	1	1	1		18
300-400	3	3	1						1	8
400-500	1		1				1			3
500-600	4	3			1	1				9
600-800	3	1	1			1				6
800-1000	3	2				1				6
1000-1500	1	1					1			3
TOTAL	25	19	10	5	3	4	4	1	1	72

DISTANCE TO WATER

	<25	25	50	75	100	150	200	300	400	500	600	700	>700	TOT
<100			2				1	3						
100-200	2	6	10	4	2	8	5	6	2		1	1		4
200-300	1	1	4	3	2	8	2	1		1			1	2
300-400		1			1		2		2		1	2	3	1
400-500		1	1	2	2		1	3		3				1
500-600	4	1	2	3	1	3	1	2		1			1	1
600-800		1		1					2	1	1	1		
800-1000	1		1	2	2	5		3		2				1
1000-1500		3	1	2	1	1				1				
>1500	1	1				1		1	1					
TOTAL	9	15	21	17	11	26	12	19	7	9	3	4	5	15

TABLE FIFTEEN
EXOTIC LITHICS FROM MIDDLEBOROUGH SITES

SITE	CHERT	JASPER	CHALCEDONY	FLINT	AGATE	TOTAL
MBO 15	2					2
MBO 20	1					1
MBO 21	6	2				8
MBO 49	1				1	2
MBO 57	2	1		6		9
MBO 59	2	1				3
MBO 61	1					1
MBO 76	2					2
MBO 85	2	1				3
MBO 91	1			1		2
MBO 108	1					1
19PL148	5					5
19PL163		1		1		2
19PL165	22	8		1		31
19PL202	6	1				7
19PL203-1	1					1
19PL203-3			1			1
19PL203-5	1					1
19PL203-6	9	1	3			13
19PL203-8	81	28	2	2		113
19PL203-B	1	15				16
19PL520	1	3				4
TOTAL	148	62	6	11	1	228

Appendix D

Pollen Analysis from Pocksha Marsh, Middleborough, Massachusetts

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Pollen Analysis from Pocksha Marsh, Middleborough, Massachusetts

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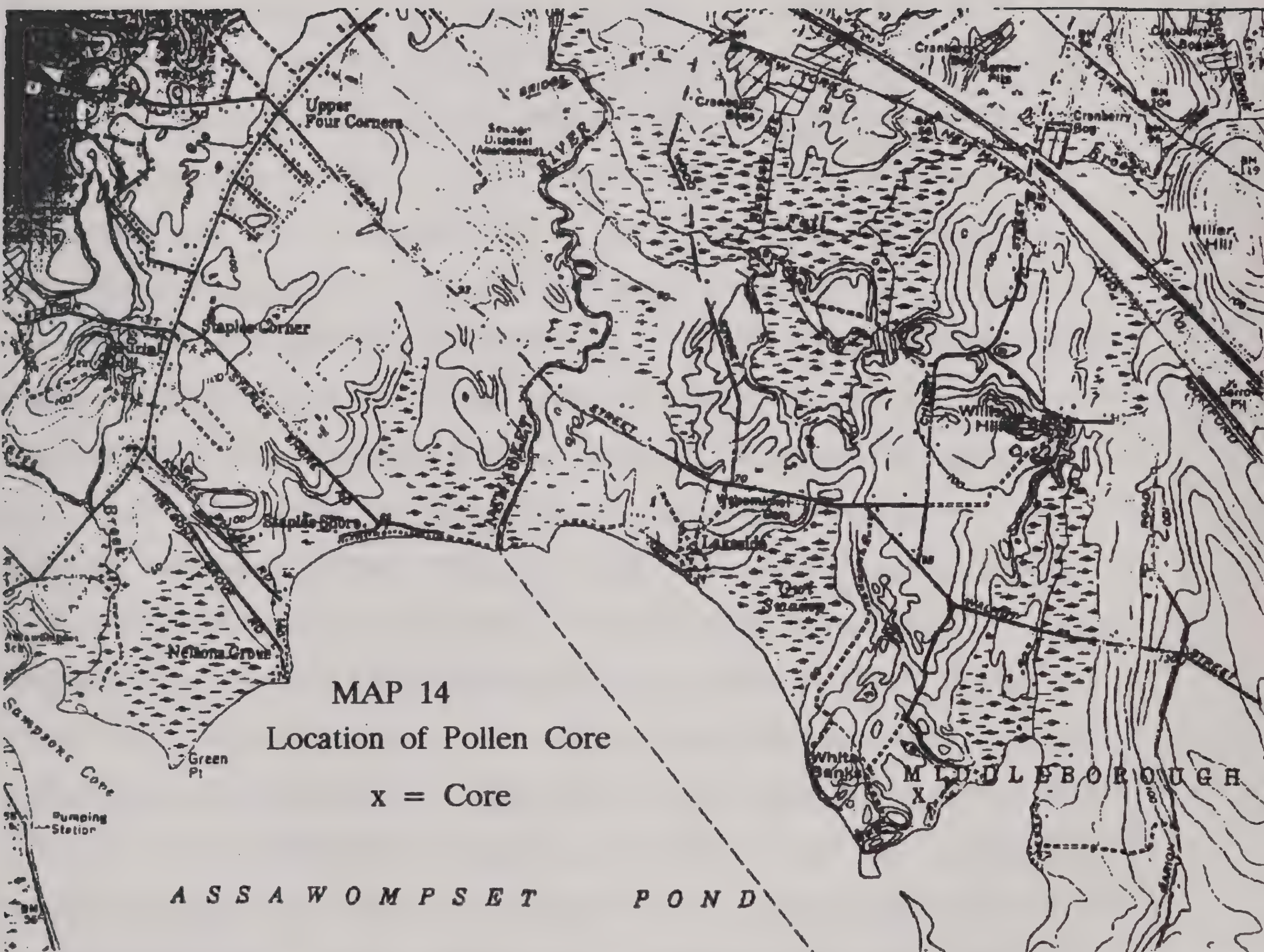
Introduction

This report presents the results of pollen analysis of a sediment core taken in Pocksha Marsh, a small, swampy catchment behind a natural dike at the northwest corner of Pocksha Pond in Middleborough, Massachusetts. Several distinct vegetation populations of varying sizes and compositions should have contributed to the pollen record of this marsh. Pocksha Pond encompasses 117 acres and is linked by permanent open water to 2404 acre Assawompsett Pond. These bodies of water are broad enough to draw upon pollen source area several hundred kilometers across. The general, homogenized pollen spectrum of the pond should reflect vegetation at the formation level and regional climate (Tauber 1965:32; Prentice 1985:81). The cored area is now a marsh, and peat layers in the profile (Figure 1) indicate that it has been marshy at several times in the past. The flora of such marshes usually reflect edaphic and hydrological factors rather than general climatic conditions. The roughly triangular marsh is bordered on one side by open water and on the other two sides by stabilized sand dunes with a tree cover that comes to the water's edge. The pollen concentration in the air within forest trunk space will be many times that over the open water, and the pollen



MAP 14
Location of Pollen Core
x = Core

contribution of the adjacent trees to the marsh should be much greater than the extra local and regional pollen brought in over the canopy from the open side of the marsh. Small marshes such as this get most of their pollen from immediately adjacent vegetation (Tauber 1965:32, 1967:278), and the wind-transported pollen in the sediment should record the vegetation growing within a few hundred meters of the core locus (Tauber 1965:32). A large portion the sediment profile recovered from the catchment, moreover, consisted of white sand that had apparently been washed off of the "White Banks", sand dunes comprising the land sides of the marsh. Sheet wash is important in concentrating pollen in marsh and pond situations such as this (Cushing 1964; Tauber 1967), and it is probable that a significant portion of the pollen spectrum, especially in sandy samples, was transported by runoff from the adjacent high ground. Most of the pollen that falls on a forest floor, the source of the runoff in this case, originated within 30 meters of the sampled spot (Anderson 1967:269), and it is probable that most of the sheetwash-transported pollen component in the marsh also reflects very local vegetation.

The majority of the pollen sources contributing to the Assawompset marsh reflect local vegetation. This, ultimately, depends on such factors as regional climate, plant migration rates and soil development. These factors add up to the local environment, and it was local environment, rather than regional climate, on which the cultural adaption of the people inhabiting the area was focused. That local environment was the objective of

this study. Specific goals were:

1) to describe the basic nature of the local vegetation at various times in the past.

2) to define changes in the vegetation and in local hydrological and sedimentary conditions reflecting environmental changes that might have required significant cultural adjustments by the people living in the area.

Methods

It was originally intended to core Pocksha Pond through the ice during January or February 1991 in order to procure a regional pollen record reflecting the general climatic sequence of the area to be covered by the Middleborough Aarchaeological Survey. The winter turned out to be very mild and the pond did not freeze. As an alternative it was decided to investigate the local environment of the prehistoric inhabitants of the immediate Assawompsett area. A number of marshes were examined. Most contained only a few feet of post-glacial deposit. Test coring indicated that only Pocksha Marsh had the potential to yield a long record, and preliminary pollen analysis indicated that prehistoric data would be recovered. An attempt to core the marsh with a stationary piston-type corer was thwarted by a layer of thick, woody plant remains about two feet below the surface. The research crew resorted to coring by driving a 2" piece of PVC into the sediment with a 20 pound sledge hammer, twisting it with a pipe wrench to break the core loose at the bottom, and withdrawing the PVC core tube with a chain hoist

suspended from an overhead H frame.

The PVC core tube was split in the laboratory on a table saw. The upper half of the tube was removed and the lower half served as a sampling tray. One hundred ninety five centimeters of core were obtained from a 224.5 cm deep hole, indicating that the sediment had compressed about 13% during coring.

The preliminary analysis of the original test core had suggested that upper meter of the marsh deposit might be post-Columbian in origin and, consequently, the bottom of the current core was sampled more heavily than the top. Fourteen samples were taken at 4-6cm intervals, adjusted to cover all natural layers, from the deepest 74 cm of core where stratigraphy was quite variable. Only two discrete layers were visible in the upper 121 cm of deposit. One sample was taken from each of these. Only the center of each core slice was analyzed to preclude contamination from the sampler wall. Pollen extraction generally followed Mehringer's (1967) procedure. A weighed sample was placed in 10% HCL to remove carbonates and then swirled and decanted to eliminate heavy minerals. The samples were than treated with HF to remove silicates and hot concentrated HCL to remove any organic colloids created by the HF. They were finally treated with warm 1% NaOH to remove humic acids, washed with distilled water until they decanted clean and the residues were mounted in glycerine for viewing. The pollen was identified at 400x with problematical grains examined under oil immersion at 1000x. Four hundred grains were counted for all samples.

Two kinds of percentage data are presented in the diagram (Figure 2). The solid color histogram displays pollen percentages of all types (arboreal, non-arboreal and undetermined) based on the total 400 grain sum of all well preserved pollen in each sample. The hollow (light color) histograms display the basic percentage multiplied by ten (10x) to clarify trends among minor pollen types considered to be significant.

Benninghoff's (1962) exotic pollen addition method was employed in computing pollen concentrations per gram of sample. These pollen concentration were not used to calculate pollen influx data for individual pollen taxa (i.e. absolute pollen frequencies). We cannot yet date the deposits with sufficient precision to generate the accurate sedimentation rates upon which pollen influx data must be based. Pollen concentrations can, however, be used with the data from individual pollen types to estimate relative density of vegetation and with sediment type to estimate relative sedimentation rate.

All pollen grains too degraded to be identified were tabulated to provide control over corrosion factors. Unidentifiable pollen grains were not incorporated in any sum from which the frequencies of other types were computed. Pollen corrosion data, however, provide a useful measure of sediment exposure to aerobic fungi (Goldstein 1960) and oxygen in percolating rainwater (Tschudy 1969). The data for the corroded pollen type, as a percentage of total identifiable and unidentifiable pollen, are presented for each sample. Corroded oak pollen grains were also tabulated as a

measure of pollen exposure to degrading agents. The terms "corroded" and "degraded" are used interchangeably and refer to any kind of pollen deterioration other than tearing. They are not intended as references to the specific classes of deterioration defined under these terms by Cushing (1964) and Havinga (1984).

Pine (Pinus) pollen grains were separated into the two sub genera defined by Ueno (1958) on the basis of the presence or absence of dorsal gemmae ("belly warts"). White pines (Pinus strobus) are the only members of the haploxlon pine sub genus, (have "belly warts") in New England. Three species belonging to the diploxlon pine subgenus (no "belly warts") are found in the northeast. These are jack pines (P. banksiana), the red pines (P.resinosa) and pitch pine (P.rigida). It is not possible at the present state of the art to reliably distinguish the pollen grains of the more northerly distributed jack pines and red pines from those of the more temperate pitch pines.

Radiocarbon dates are not yet available for this core. The pollen succession recording post-glacial vegetation developments on a regional scale has, however, been reasonably well established for a number of years (Deevy 1939), and paleobotanists are making good progress at documenting the arrival of individual genera by the first appearance of their pollen in dated pollen spectra (Bernabo and Webb 1977; Davis 1983). Modern vegetation communities are the products of migration rates for different genera as well as climate change and these bio-chronometric data can be used to establish approximate dates for the Pocksha Marsh pollen spectra.

Results

Soil Stratigraphy

The stratigraphy of the Pocksha Marsh core was quite complex. Twelve distinct layers were evident (Figure 1). The deepest of these is a sandy dark gray clay (layer 1). This is the typical bottom deposit of a glacial melt water lake and indicates that our core has reached late Pleistocene deposits. In layer 2 bands of gyttja (highly organic lake and pond bottom deposits) appear in the glacial lake clay, attesting to the development of vegetation in the vicinity. Layers 3, 4 and 5 are all gyttja deposits of various colors. Layer 5 is more sandy than the two layers below and is succeeded by a very sandy gyttja deposit (layer 6) containing bands of dark gray sandy silt. Layer 7 consists of white sand with black organic lenses. Layer 7 may record the formation of the dunes of white sand above the marsh. A narrow band of sandy black gyttja (layer 8) above was succeeded by a sequence of inclined, alternating bands of white sand and dark brown organic silt (layer 9) suggesting deposition of material eroded off the dunes above on a periodically exposed slope. The shore line of the pond could also be indicated. These inclined microbeds were followed by ca. 20 cm of black peat (layer 10) containing numerous sticks and other large plant remains> This appears to record conversion of the lake or pond edge into marsh, and the natural dike that cuts Pocksha Marsh off from Pocksha Pond may have formed at this time. This first marsh deposit was followed by 30 cm of white sand containing

lenses of organic silt (layer 11) that appears to record a significant episode of erosion on the adjacent dunes. More stable conditions in recent times are recorded in the ca. 25 cm of peat (layer 12) under the present marsh at the top of the sequence.

Pollen Stratigraphy

Four basic pollen zones are evident among the Pocksha Marsh pollen spectra (Figure 2). These generally conform to the regional sequence of the tundra, first recognized by Davis (1967), and the spruce (A) zone, the pine (B) zone, and the Oak (C) zone defined by Deevy (1939) some 50 years ago.

Pollen Zone 1. The earliest pollen zone in the Pocksha Marsh core consists of samples 1 and 2. The zone conforms to the gray glacial clay and gyttja streaked glacial clay of Layers 1 and 2. This pollen zone is dominated by arboreal pollen (63%). Most of this pollen belongs in the diploxlon pine subgenus and was probably contributed by the boreal jack pines (Pinus banksiana). Fourteen percent (14%) birch (Betula) pollen was also recovered and smaller quantities of spruce (Picea), oak (Quercus), alder (Alnus), willow (Salix),and ash (Fraxinus) pollen were observed. This zone also contains a broad range of non-arboreal pollen types, including grass (Gramineae), ragweed-type (Ambrosia-type), pollen attributable to insect-pollinated types such as asters, daises and goldenrod (Aster-type), wormwood (Artemisia), goosefoot family (Chenopodiaceae), pink family (Caryophyllaceae), meadow rue

(_Thalictrum_), other members of the buttercup family (Ranunclaceae), rose family (Rosaceae), currants (_Ribes_), violets (_Viola_), and heath family (Ericaceae). Significant quantities of pollen from the aquatic waterleaf (_Myriophyllum_), the shallow water preferring cattails (_Typha_) and the moist ground adapted sedges (Cyperaceae) were also recovered. Sample 1 contained more non-arboreal pollen, by percentage, than any other sample in the profile, while pollen concentrations per gram of matrix were very low in the zone. Relatively little organic material was noted in the core at this zone.

Tree pollen is more frequently wind-transported greater distances than non-arboreal pollen and is better represented in the regional pollen rain. Between 16,000 and 40,000, mostly arboreal, pollen grains are deposited annually on each square cm of exposed surface in temperate eastern North America (King, Klipple and Duffield 1975:181). When large percentages of tree pollen, especially of heavy pollinators like pines (Erdtman 1969), are found in sediments with low pollen concentrations, it is probable that the tree pollen was transported some distance and fell on relatively bare ground (Martin 1963, Figure 2; Tauber 1965:33). Davis (1967) used this phenomenon, together with the presence of herb pollen, to first isolate tundra levels in the tree-dominated early post-glacial pollen record of New England. Sedge pollen, characteristically important in other tundra pollen records (Davis 1983:167) dominates Pocksha Marsh pollen zone 1, where concentrations are relatively low, and there is little doubt

that samples 1 and 2 actually record tundra. This zone probably dates sometime between 13,000 and 15,000 years before present. The apparent absence of organic material in level 1 and the appearance of small quantities of gyttja in level 2 suggest that vegetation in the vicinity was not dense enough to contribute much organic material to the lake, but the importance of heath family and willow pollen in the non-arboreal counts suggests that the spectrum may not reflect the earliest tundra in the area (Davis 1983:168).

A few inferences about the nature of the ground cover during deposition of zone 1 are possible. Herb pollen, especially insect-pollinated types like heath, asters, roses and buttercups and heavy, wind-transported types like sedge and cattail (Davis, Brubaker and Beiswenger 1971:460; Handle 1976:422) are poorly dispersed and all of the non-arboreal pollen types listed above reflect vegetation actually on the ground. The jack pine dominated woodland that was advancing north in the wake of the glacier was getting closer, but the small size of the increase in pollen concentration in sample 2 suggests that few, if any, specimens of the major trees contributing pollen to the spectrum were present near the sampling site. Willow, however, is insect-pollinated and was probably growing in the immediate vicinity. The relatively small size of the birch pollen grains recovered from levels 1 and 2 also suggest that dwarf birch (Betula nana), a common element in present-day Arctic tundra (Davis 1983:168), was growing not too far away (Figure 3). The presence of pollen from waterleaf indicates that the spectrum was deposited in the lake

water with the gray clay rather than on exposed lake bed surfaces, and the willow and cattail pollen, which do not move far from the parent plants when deposited in aquatic situations (Davis, Brubaker and Beiswenger 1971:460) suggest that the shoreline was not far distant.

Pollen Zone 2. Pollen samples 3 and 4 in layers 4 and 5 constitute Pocksha Marsh pollen zone 2. Spruce is generally recognized as the first tree to colonize the late-glacial landscape (Davis 1983:169), and this zone is a local manifestation of Deevy's (1939) pollen Zone A (spruce period). It is characterized by an abrupt increase and decline of spruce pollen. Spruce pollen is very poorly dispersed (Heide and Bradshaw 1982:16) because the bladders of this vesiculate type are filled with water (A.M. Solomon, personal communication, 1985), and the pollen concentrations increase and decrease parallel to the percentages of this pollen type. There is little question that a population of spruce trees actually developed in the vicinity of the sampling locus, and the development of gyttja at the sampling locus attests to the greater quantity of organic material in the system. In western Massachusetts the spruce period opened ca. 12,000 to 12,500 before present (Davis 1983:169), and spruce trees may have appeared slightly later in the Middleboro area.

It is generally understood that the spruce invasion of the Northeast did not produce a closed forest similar to the boreal forest now present in Canada (Davis 1983:169). This was apparently

also the case in Middleboro, because here, as at other sites, relatively large quantities of herb pollen carry over into this zone and suggest an open vegetation with spruce trees scattered on a tundra landscape (Davis 1983:169). Jack pine pollen frequencies were only modestly statistically depressed by the spruce peak in sample 3, while pollen concentrations increased, from 5,000 to 65,000 pollen grains per gram between samples 2 and 3. The spruce peak does not appear to be large enough to account for this 1300% rise, and it is probable that jack pines had arrived and were coexisting with the spruce. It is possible that the jack pines had actually arrived somewhat earlier, but records from Connecticut, southern New Hampshire and northeastern New York place the spruce first (Davis 1983:169). Fir (Abies) should have arrived about the same time (Davis 1983:169) but is represented by only a single pollen grain in sample 5 at Pocksha Marsh. An increase in the mean size of birch pollen grains and a brief depression in the birch pollen percentage in sample 3 suggests that dwarf birch passed out of the flora as spruce pollen peaked and was not immediately replaced by related species. Spruce populations appear to decline abruptly ca. 11,000 to 10,500 years ago (Snedden and Kaplan 1987:4; Davis 1983:172), while the jack pines persisted for some time. Influx data from other loci suggest, however, that the sudden nature of the decline indicated by percentages was partially a product of statistical constraint from rising white pine (Pinus strobus) frequencies and actually lasted about a thousand years (Davis 1983:172). Pollen concentrations increase in Pocksha Marsh

as spruce percentages decline suggesting that here as well, significant numbers of spruce trees may have existed among the pines longer than the relative frequencies suggest.

Pollen Zone 3. An abrupt increase in white pine (Pinus strobus) pollen percentages, as spruce and jack pine representation declines, marks the invasion of the Pocksha Marsh area by these temperate zone conifers at the beginning of local pollen zone 3 (samples 5, 6 and 7). A peak in birch pollen suggests that there were more such trees in the vicinity and increases in elm (Ulmus), ash (Fraxinus), and hemlock (Tsuga) pollen suggest that these trees arrived with, if not slightly before, white pine. Red maple (Acer rubrum) appears slightly later (sample 6), and the increase in oak (Quercus) occurred (sample 7) after white pine populations had begun to decline. This is Deevy's (1939) regional pine period (Zone B). The arrival of these temperate zone conifers ca. 10,500 to 11,000 years ago (Davis 1983:172; Sneddon and Kaplan 1987:5) marks the development of true forests as conditions warmed at the end of the Pleistocene. At one other location the thickening forest is reported to have shaded out grass and sedge (Sneddon and Kaplan 1987:6), but here at Pocksha Marsh a decline in all non-arboreal types - aquatic, shallow water, and moist ground as well as dry land adapted taxa - started with the entry of spruce and climatic factors influencing groundwater levels may also be involved. The forest around **Indian Neck Marsh** differed somewhat from that recorded in Rodgers Lake, Connecticut (Davis 1969:Figure

5) and other northeastern sites, but this appears to be the product of differences in the migration rates and starting points of individual taxa rather than differences in climatic adaption (Davis 1983:172). Pollen concentrations were very high in the gyttja from which samples 5, 6 and 7 were taken, suggesting the presence of a high pollen contribution from a dense goundcover that slowed the sedimentation rate by preventing erosion.

Pollen Zone 4. Pocksha Marsh pollen zone 4 encompasses the profile section between sample 7 or 8 and the surface of the marsh deposit. Zone 4 is Deevy's (1939) northeast regional oak period (Zone C) and should date ca. 10,000 years ago (Sneddon and Kaplan 1987:6) to the present. The appearance of beech (Fagus) around sample 8 or 9 dates that section of the local core to ca. 8,000 years ago, an increase in hickory (Carya) pollen between samples 9 and 10 records the advent of those trees ca. 5,000 years ago and the presence of chestnut (Castanea) pollen in samples 15 and 16 suggests that the upper meter of the deposit formed during the last 2,000 years (Davis 1983:Figure 11-7).

In the regional sequence (Davis 1969:419) and at other Massachusetts sites (Sneddon and Kaplan 1987:6-10) the oak period can be divided into three sub-zones: the oak-hemlock period (C-1) at ca. 10,000 to 4,700 before present, the oak-hickory period (C-2) at ca. 4,700 to 2,000 years before present and the oak-chestnut period (C-3) from 2,000 years ago until the present. The oak-chestnut period is normally further split into prehistoric (C-3a)

and historic eras (C-3b) on the basis of the proliferation of ragweed and plantain (Plantago) pollen with the advent of Euroamerican plow agriculture about 300 years ago (Davis 1965:395). Most features of the Pocksha Marsh pollen sequence are consistent with this sequence and with local records from other loci in New England. Hemlock (Tsuga), hickory and chestnut all increase in the proper sequential order and beech appears at the proper level, just after oak (Davis 1983: Figure 11-3; Sneddon and Kaplan 1987:6). The hemlock sequence is however, rather irregular, obscuring any possible local evidence for the pathogen caused hemlock decline that has been recorded in most northeastern pollen sequences (Davis 1983:177; Sneddon and Kaplan 1987:9).

The addition of holly (Ilex) and, somewhat later, gum (Nyssa) and members of the grape family (vitaceae) to the local flora during pollen zone 4 (oak period) should be noted. There is, moreover, some fairly subtle evidence for changes in the kinds of birches present at the beginning of this interval. During pollen tabulation all birch pollen grains were measured as part of a search for the normally smaller pollen grains of the boreal dwarf birchs. When these measurments were diagrammed (Figure 3) it became evident that there was a significant shift toward larger size birch pollen grains above sample 7, where oak pollen representation increases. It is possible, if not probable, that at least one new species of birch entered the local flora at this time.

Oak declines in sample 15, suggesting historic lumbering and the increase in pitch pine (Pinus rigida) in sample 16 in the vicinity implies reseeding of the duens during the historic period vegetation. Other expected recent vegetation changes are not recorded in the Pocksha Marsh core, perhaps because the sand dunes above the site offered little to the colonial farmer.

Most of the pollen zone 4 (oak period) trends discussed in the previous several paragraphs originated in regional tree migration patterns, and, with a few exceptions (Bernabo and Webb 1977, Delacort 1979) analysts avoid describing local, or even regional climatic patterns for this segment of the holocene on the basis of tree pollen alone. Most researchers employ non-arboreal pollen data and non-botanical measures such as fire frequency and sediment composition to define environmental shifts (Swain 1973, Davis 1983:177, Davis and Ford 1981). Several such lines of evidence for local environmental change are available from the Pocksha Marsh core. Among these is changing sediment type. The gyttja (organic pond bottom sediments) of pollen zone 2 became progressively more sandy during deposition of pollen zone 3. Sediment type changed markedly in zone 4, first to alternating bands of sandy gyttja and very sandy silt during deposition of samples 7, 8, and 9 at the bottom of the zone and then to alternating deposits of white sand and organics between samples 9 and 13. The appearance of the white sand, which is characteristic of the "White Banks" sand dunes above the marsh, suggests that the dunes began to form at this time. The alternating bands of

sediment may indicate sheetwash off of the dunes, while a marked decline in pollen concentrations during this deposition interval, implies a decrease in groundcover and/or an increase in sedimentation rate in the marsh basin due to erosion from the denuded dunes. During this same interval the percentages of pollen grains that are too corroded to recognize and the proportion of oak pollen grains that are visibly degraded increase. Pollen corrosion is normally attributed to only be attributed to greater exposure of free oxygen and aerobic fungi and strongly suggests the that the marsh basin was drying out at least periodically. Ragweed also reappears in the pollen record, with a sharp percentage peak in sample 9, during deposition of pollen zone 4. This occurs about the same time that beech pollen appears in the core, suggesting that the reintroduction of ragweed took place just after 8,000 years ago. Similar ragweed pollen peaks in other parts of New England have been dated to ca. 7,300 years ago (Sneddon and Kaplan 1987:7, Winkler 1985:8, Davis 1969:419) and are considered to record a continental scale mid-Holocene dry period in pollen spectra as distant as the Southwestern United States (Mehringer 1966:97). The correlation of data suggesting dune formation, erosion, a declining water table, and the expansion of weeds adapted to hot dry, disturbed soils (Bazzas 1976) must indicate that this arid interval is recorded in at least the lower portion of Pollen zone 4 at Pocksha Marsh.

There is some debate whether the ragweed pollen marking this "hypsithermal" period in other New England sites was locally

produced (Davis 1969:419) or blown in from the mid-west (Wright 1968:83). At Cedar Swamp, for instance, the ragweed contribution peaks and disappears from the spectrum until reintroduced with plow agriculture in the Euroamerican era (Sneddon and Kaplan: Figure 2), and there is no way to determine its point of origin. At Pocksha Marsh, however, ragweed remains part of the spectrum through sample 15. The formation of peat and concurrent increases in pollen concentrations and decline in pollen degradation in samples 13 and 14 suggest a decrease in erosion and resurgence of the water table marking the end of the "hypsithermal" by deposition of layer 10. This, in turn, implies that the ragweeds shedding the pollen were local plants that became established on the dunes during the "hypsithermal" and persisted until suppressed by the recent expansion of pitch pine recorded in sample 16. It should be noted that the that there is no evidence in Pocksha Marsh of the dry period around 3,000 years ago that Bradshaw, Nelson and McGown (1982:7-8) noted in three cores from the Taunton, Massachusetts area.

The formation of a ca. 55 cm deposit of organic stained white sand some time after chestnut migrated into New England ca. 2,000 years ago (sample 15) and the subsequent development of almost 50 cm of peat (sample 16) at the top of the Pocksha Marsh profile suggest significant changes in erosion and water table height over the last several thousand years. The sand may reflect erosion following colonial lumbering on the dunes, and there is an improvment in pollen preservation at the top of the profile (sample

pollen spectra (samples 7-16) of the oak period (10,000 b.p. - present), and changes in the local environment suggesting dune formation, erosion and water table depression can be tied to the mid-Holocene hot, dry period (hypsithermal) by stratigraphy and the local proliferation of ragweed populations. No evidence for the ca. 3,000 dry period noted by Bradshaw, Nelson and McGown (1982:7-8) for the Taunton, Massachusetts area was found in Pocksha Marsh. Winkler (1985) did not record the interval on Cape Cod, and Sneddon and Kaplan (1987) do not mention any such incident in their Westborough, Massachusetts core. The xeric period at Taunton appears to be a local groundwater phenomenon and should be further investigated.

A peat-sand-peat stratigraphic sequence in Pocksha Marsh above sample 13 suggests significant local environmental change sometime after the arrival of chestnut 2,000 years ago. The sand and upper peat seem to be post-Columbian in age, but neither the date nor the nature of these events are clearly indicated among the pollen spectra. Further study of this part of the Pocksha March profile is needed.

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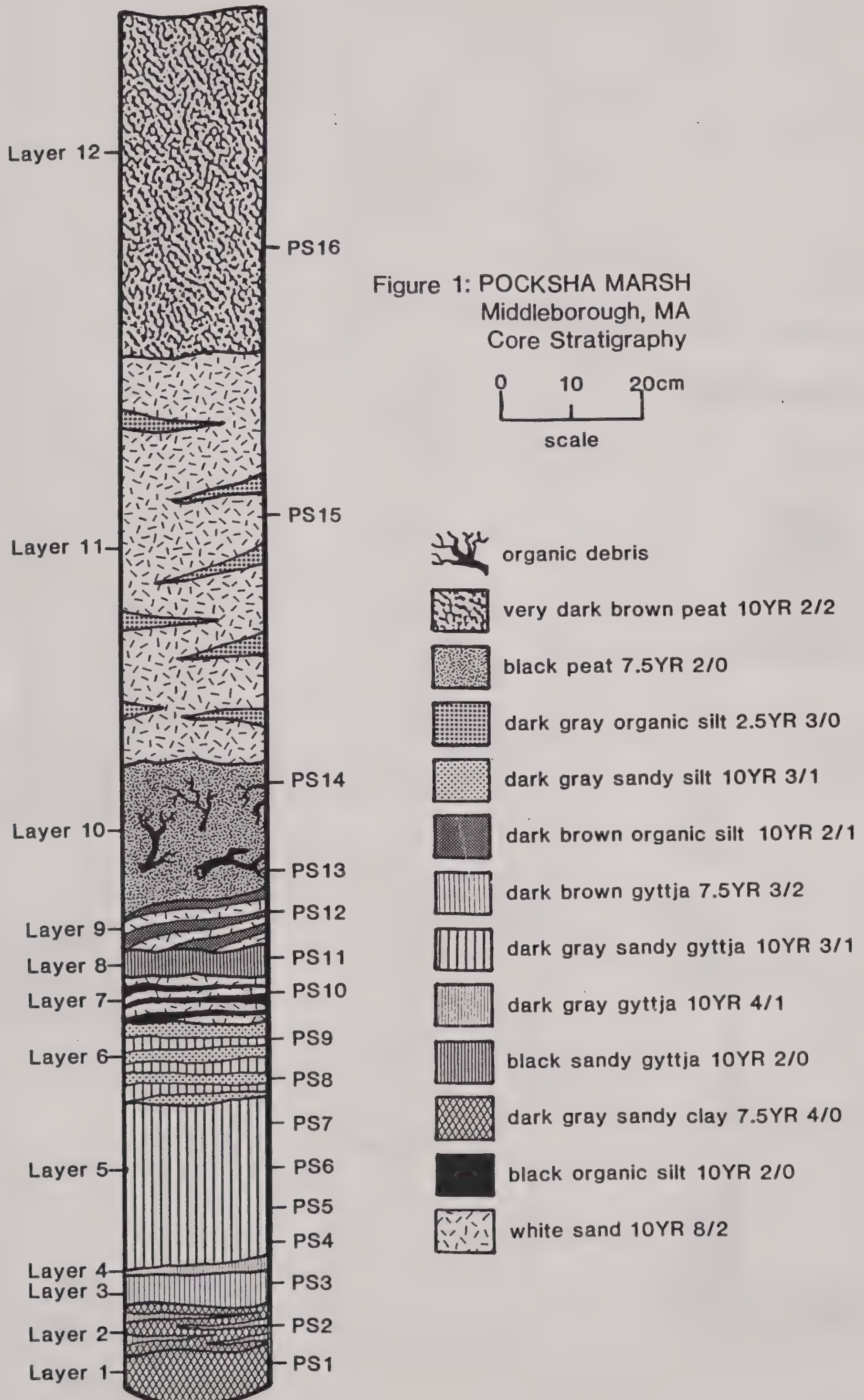

Figure 1: POCKSHA MARSH
Middleborough, MA
Core Stratigraphy

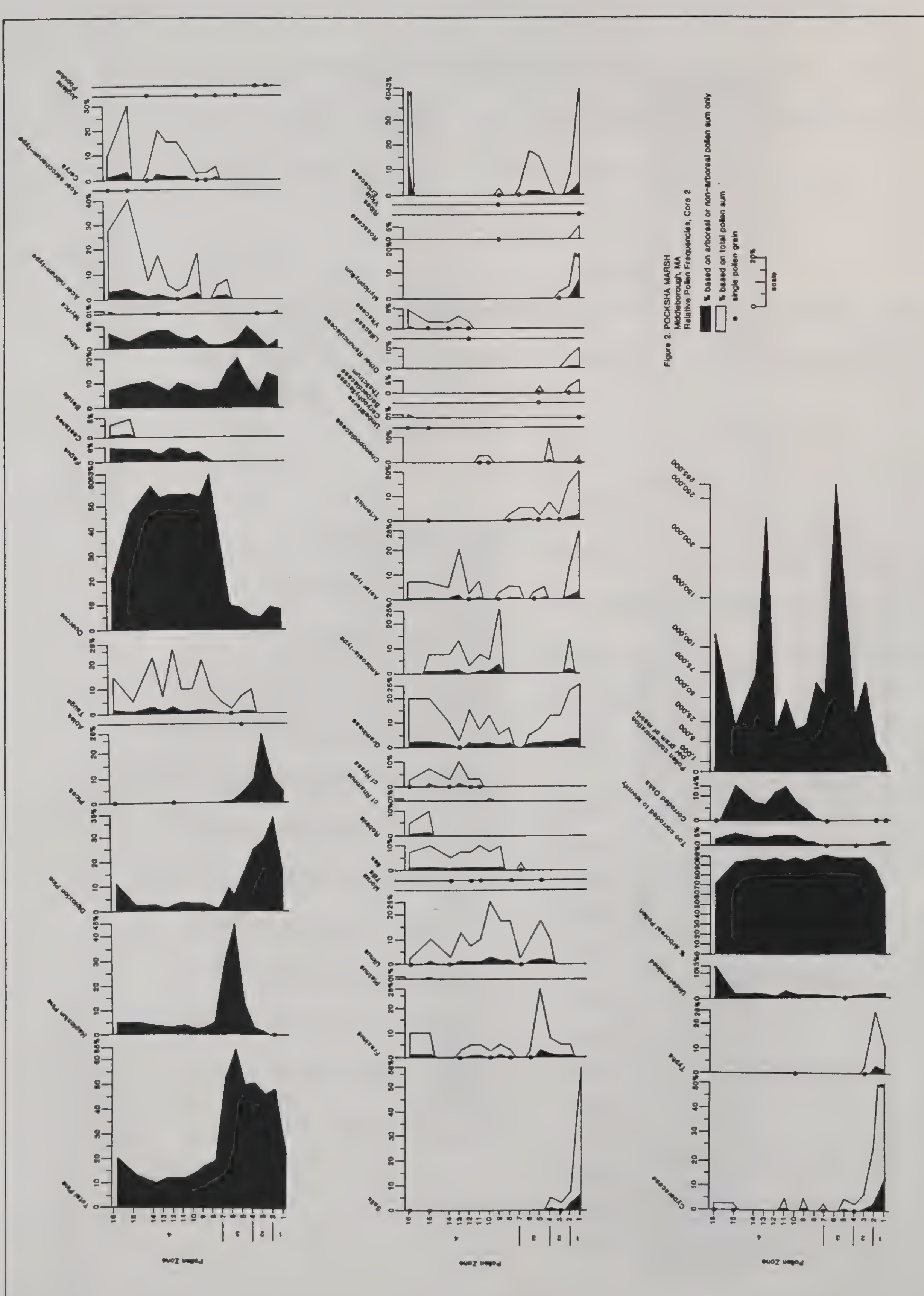

Figure 2. POCKSHA MARSH
Middleborough, MA
Relative Pollen Frequencies, Core 2

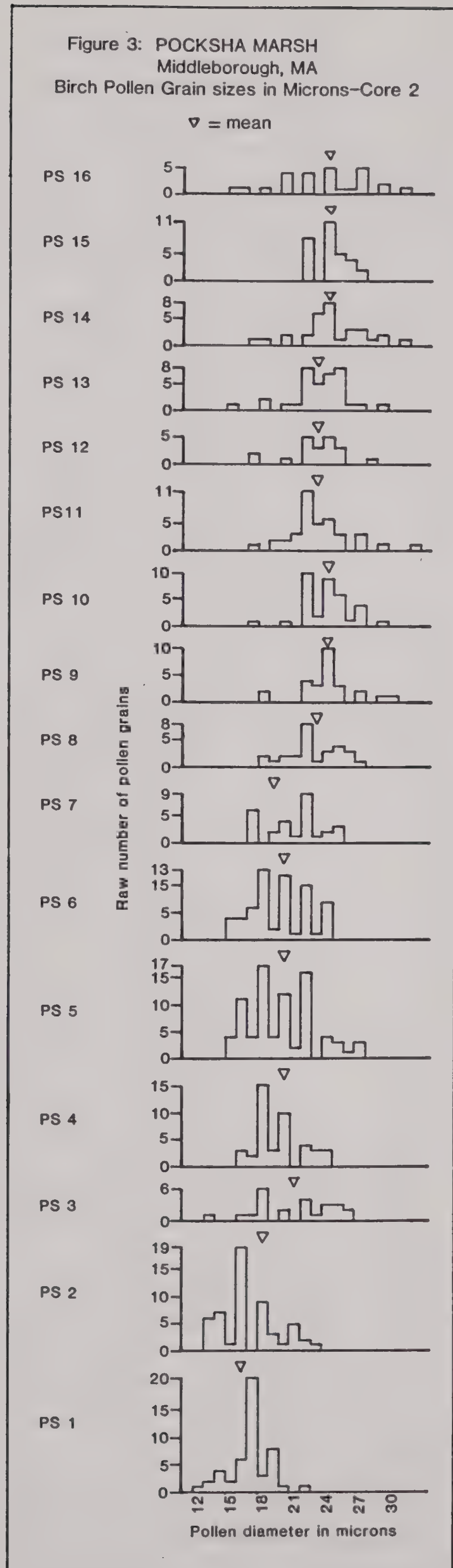
Figure 3: POCKSHA MARSH
Middleborough, MA
Birch Pollen Grain sizes in Microns–Core 2
▽ = mean
PS 16
PS 15
PS 14
PS 13
PS 12
PS11
PS 10
PS 9
PS 8
PS 7
PS 6
PS 5
PS 4
PS 3
PS 2
PS 1
Raw number of pollen grains
Pollen diameter in microns
12
15
18
21
24
27
30

TABLE SIX
OTHER STONE TOOLS FROM MIDDLEBOROUGH

SITE NAME	ABRADER	ADZE	ANVIL	OVAL ATLATL	BOWTIE ATLATL	WINGED ATLATL	WHALTL ATLATL	ATLATL FRAG	CHIPPED AX	FULLGROOVD AX	CELT	COUNTER	DIGGING TOOL	GORGET	KNOBBED GOUGE	GROOVED GOUGE	PLAIN GOUGE	HAMMERSTONE	GRVD HAMMRSTN	HAND SPADE	HATCHET	STEMMED HOE	TRIANG. HOE
MBO 5																				1			
MBO 8																							
MBO 11										1													
MBO 15	1																						
MBO 18																							
MBO 21										2	2	1					1			1			1
MBO 22											1												
MBO 25																							
MBO 26																							
MBO 46																							
MBO 47																		4					
MBO 49				1			1			2	1							1					
MBO 51																							
MBO 54										1							1						
MBO 55	1																			2			
MBO 57				1														1					
MBO 58																		1					
MBO 61										1													
MBO 66																		1					
MBO 75	1																						
MBO 76																							
MBO 83											1												
MBO 93																		1					
MBO 95																							
MBO 100																							
MBO 101																							
MBO 119	2																						
19PL148											2				1		3						
19PL163																		1					
19PL165					1				3		1			1			2	5			3		
19PL202								1							1								1
19PL203	1									1						1							
19PL203-1	1					1		1	3	3				1				2			2		
19PL203-3		1								1	5							3					
19PL203-4																		1					
19PL203-5				1	1			1						1				1				1	
19PL203-6		1			2				1		7			1			3	5				1	1
19PL203-7					1								1										
19PL203-8	7	3	4	1	4	2		1		1	7		6				7	57	1	5		3	3
19PL291			1															2					1
19PL397																							
19PL409																							
19PL411													2										
19PL412													1	1									
19PL414																							
19PL520																							
19PL585																							
19PL592			1															2					
	14	5	6	4	9	3	1	4	7	13	27	1	10	5	2	1	17	88	1	9	5	5	7

SITE NAME	HOLE STONE	MAGIC STONE	MANUPORT	MORTAR	MULLER	NUTTING STONE	PAINTSTONE	PENDANT	PESTLE	PETROGLYPH	CLASSC PLUMMT	CLUMSY PLUMMT	POUNDER	PITTD POUNDER	STONE ROD	RUBBING STONE	SINEW STONE	SLAB	TAILING BREAKR	GROOVD WEIGHT	NOTCHD WEIGHT	WHETSTONE	PECKED FRAG.	TOTAL
MBO 5																								1
MBO 8									1															1
MBO 11																								1
MBO 15												1												2
MBO 18										1														1
MBO 21	1				2		3		6		1	2	3		2						1		1	30
MBO 22																								1
MBO 25		1							1															2
MBO 26									1															1
MBO 46									1															1
MBO 47																	1							5
MBO 49								1	4			1												12
MBO 51																				1				1
MBO 54																								2
MBO 55		1		1																				5
MBO 57																								2
MBO 58																								1
MBO 61								2	1														1	5
MBO 66																								1
MBO 75																								1
MBO 76																							1	1
MBO 83																								1
MBO 93																								1
MBO 95																					1			1
MBO 100								1																1
MBO 101		1							2															3
MBO 119																								2
19PL148																								6
19PL163		1						1		1														4
19PL165							1	8			1	3			1	2						1		33
19PL202							1		2			1			1	1					1			10
19PL203							1																	4
19PL203-1						1	3	3	3					1						1	2	2	3	33
19PL203-3									3											1				14
19PL203-4																								1
19PL203-5								2		1	1	1				1						1		13
19PL203-6		2					1	2	3		1					1	1			1	6	2		42
19PL203-7																1						2		5
19PL203-8	2	1	1	1	3	1	34	5	9		1	15	3	2	1	27	1	212	1	3	29	24	12	500
19PL291							3			2						1							2	12
19PL397													1											1
19PL409			3																				1	4
19PL411			3							1	1												1	8
19PL412											2												1	5
19PL414			4							2	14													20
19PL520							1									1								2
19PL585																						1		1
19PL592																								3
	3	7	11	2	5	2	48	25	37	8	22	24	7	3	5	35	3	212	1	7	40	33	23	807

TABLE THREE
MIDDLEBOROUGH PREHISTORIC INVENTORY
CULTURAL PARAMETERS

SITE #	# OF ARTFCTS	AGE OF COMPONENTS PI	EA	MA	LA	TA	EW	MW	LW	CO	UN	INTEN-SITY	SITE FUNCTION CE	CP	FI	FP	FS	HO	HU	TM	TR	WW	NEAREST NEIGHBOR
MBO 1	1										X					X							350
MBO 2	0										X									X			200
MBO 3	3				X							3							X				1425
MBO 4	3				X							3				X			X				325
MBO 5	1										X						X						1225
MBO 6	1								X			1							X				600
MBO 7	1				X							1							X				200
MBO 8	2				X							2				X			X				950
MBO 9	1										X									X			525
MBO 10	3										X									X			925
MBO 11	5										X					X							125
MBO 12	2										X									X		X	200
MBO 13	0										X									X			275
MBO 14	0										X									X			125
MBO 15	189		X	X	X	X	X	X	X			27		X	X	X			X	X	X		250
MBO 16	6			X	X	X	X					1				X			X	X			150
MBO 17	1				X							1							X				275
MBO 18	1										X		X										125
MBO 19	2			X								2	X			X			X				250
MBO 20	1									X		1							X		X		900
MBO 21	214	X	X	X	X	X	X	X	X			27		X	X	X	X	X	X	X	X	X	550
MBO 22	1										X											X	200
MBO 23	2										X					X							1150
MBO 24	12			X	X	X	X		X			2							X				950
MBO 25	7			X	X							4	X			X			X		X		175
MBO 26	26				X	X	X	X	X			6				X			X				175
MBO 27	1						X					1		X									275
MBO 28	3										X					X				X			1215
MBO 29	1										X									X			625
MBO 30	1										X					X							125
MBO 31	1										X								X				175
MBO 32	3					X	X					2							X				650
MBO 33	1										X					X							175
MBO 34	1										X									X			225
MBO 35	0										X									X			2425
MBO 36	0										X									X			975
MBO 37	1				X							1							X				250
MBO 38	1										X									X			150
MBO 39	1										X									X			575
MBO 40	1										X									X			1775
MBO 41	3										X					X							925
MBO 42	3										X					X							575
MBO 43	3										X					X							575
MBO 44	4										X									X			350
MBO 45	3										X					X				X			350
MBO 46	1										X					X							950
MBO 47	8										X					X				X			150
MBO 48	14			X	X	X	X		X			3		X		X			X	X			325
MBO 49	70		X	X	X	X	X	X	X			10		X	X	X				X	X	X	225
MBO 50	2										X					X							200
MBO 51	1										X				X								125
MBO 52	2										X									X			1750
MBO 53	1										X									X			500
MBO 54	2										X											X	1650
MBO 55	9								X			9	X						X				125
MBO 56	2				X							2			X				X				725
MBO 57	42		X	X	X	X	X	X	X	X		5				X			X	X	X		225
MBO 58	1										X									X			150
MBO 59	33		X	X	X	X	X	X	X			5		X		X			X		X	X	200
MBO 60	1										X									X			500
MBO 61	22			X	X	X	X	X	X			4		X		X			X		X	X	575
MBO 62	29				X				X			14					X		X		X		200
MBO 63	9				X				X			4				X			X	X			125
MBO 64	24	X		X	X	X	X					5				X			X				125
MBO 65	1						X					1							X				400
MBO 66	8										X					X				X			475
MBO 67	2										X									X			450
MBO 68	4										X					X							475
MBO 69	7										X					X				X			750
MBO 70	0										X									X			1000
MBO 71	2										X					X							1025
MBO 72	1										X									X			775
MBO 73	1							X				1											300
MBO 74	5				X							5							X				875
MBO 75	2						X					2							X				550
MBO 76	42		X	X	X	X	X	X	X			6				X			X	X	X		300
MBO 77	2				X							2							X				550
MBO 78	6					X		X	X			2	X						X				375
MBO 79	5				X							5				X				X			200
MBO 80	2										X					X				X			775
MBO 81	1					X						1	X										275
MBO 82	3										X					X				X			1175
MBO 83	1										X											X	150
MBO 84	6				X				X			3							X				600
MBO 85	10	X		X	X	X	X		X			2	X			X			X		X		150
MBO 86	3										X					X				X			2225
MBO 87	2										X									X			525
MBO 88	1										X									X			300
MBO 89	0										X									X			550
MBO 90	4				X	X						2	X						X				225
MBO 91	7					X						7				X			X	X	X		400
MBO 92	4			X	X	X	X					1							X				300
MBO 93	2										X									X			125
MBO 94	3										X									X			200
MBO 95	8										X				X	X				X			475
MBO 96	1										X									X			900
MBO 97	1										X									X			575
MBO 98	1										X									X			900
MBO 99	1				X							1							X				500
MBO 100	3					X						3	X										525
MBO 101	23				X	X	X	X	X			5	X	X		X			X				975
MBO 102	1										X					X							275
MBO 103	1										X									X			500
MBO 104	10										X					X				X			500
MBO 105	4										X					X				X			350
MBO 106	1										X									X			350
MBO 107	1										X									X			350
MBO 108	1					X						1			X						X		1200
MBO 109	22				X	X	X	X				6		X		X			X				150
MBO 110	3										X									X			200
MBO 111	1										X									X			950
MBO 112	1										X									X			450
MBO 113	0										X									X			150
MBO 114	0										X									X			125
MBO 115	0										X									X			225
MBO 116	0										X									X			225
MBO 117	1					X						1					X				X		175
MBO 118	1						X					1			X								550
MBO 119	2										X											X	950
MBO 120	8										X					X				X			825
19PL148	90			X	X	X	X	X	X			15	X	X		X	X		X	X	X	X	150
19PL155	2										X								X	X			1425
19PL163	130		X	X	X	X	X	X	X	X		16	X	X		X			X	X	X		275
19PL165	314	X	X	X	X	X	X	X	X	X		35	X	X		X			X	X	X	X	200
19PL202	166			X	X	X	X	X	X			28		X	X	X		X	X	X	X	X	475
19PL203-B	21	X	X	X	X		X	X	X			4				X			X	X	X		100
19PL203-U	120		X	X	X		X	X	X			20		X		X			X	X	X	X	550
19PL203-1	92			X	X	X	X	X	X	X		13	X	X	X	X	X		X	X	X	X	150
19PL203-2	13		X	X	X		X			X		3	X				X		X		X		150
19PL203-3	39				X		X			X		13		X		X			X		X	X	100
19PL203-4	6				X					X		3				X	X		X		X		50
19PL203-5	104			X	X	X	X	X	X			17		X	X	X		X	X		X		50
19PL203-6	253		X	X	X	X	X	X	X			36	X	X	X	X	X	X	X	X	X	X	100
19PL203-7	23				X		X		X			8			X	X			X	X			100
19PL203-8	1956	X	X	X	X	X	X	X	X			244	X	X	X	X	X	X	X	X	X	X	350
19PL291	277				X	X	X	X	X			55		X		X	X		X	X	X		225
19PL397	27					X						27			X				X	X			600
19PL409	12				X							12		X		X			X	X			225
19PL411	20			X	X							10		X		X			X	X			600
19PL412	70			X	X							35				X			X	X			1300
19PL414	58			X	X							29		X		X			X	X			800
19PL421	8				X							8				X			X			X	225
19PL482	0										X									X			1050
19PL520	28		X	X	X	X	X	X	X			4				X			X	X	X		300
19PL531	1										X									X			375
19PL535	0										X									X			975
19PL585	8				X				X			4			X	X			X	X			550
19PL588	1										X		X			X							275
19PL589	0										X									X			75
19PL590	0										X									X			75
19PL591	0										X									X			100
19PL592	14								X			14								X			100
19PL593	0										X									X			75
19PL594	0										X									X			75
19PL595	0										X									X			175
19PL596	0										X									X			100
19PL597	0										X									X			100
19PL598	0										X									X			125
19PL599	0										X									X			125

TABLE FIVE
OTHER CHIPPED STONE TOOLS FROM MIDDLEBOROUGH

SITE NAME	STEM KNIFE	STEMLESS KNIFE	FLAKE KNIFE	U-BASE KNIFE	SQ. BASE KNIFE	ROUGH. KNIFE	SMILUNR KNIFE	LEAF KNIFE	NOTCHER	KNIFE FRAGS	END SCRAPER	SIDE SCRAPER	FLAKE SCRAPER	UNIF. SCRAPER	OVAL SCRAPER	STPEDGE SCRPR	THUMB. SCRAPER	SCRAPER FRAGS	CHOPPER	NEVILLE DRILL	STARK DRILL	T-BASE DRILL	EARED DRILL	DIAMOND DRILL	MEADOW DRILL	TPRDSTM DRILL	REAMER	ATLANTIC DRILL	S-NOTCH DRILL	CRESCNT DRILL	PLAIN DRILL	FLAKE DRILL	DRILL FRAGS	UTILIZED FLAKE	WEDGE	SPOKESHAVE	GUNFLINT	CORE	PREFORM	GRAVER	STRIKE-A-LITE	FLAKE SHAVER	BURIN	QUARRY DISK	BIFACE FRAG.	TOTAL
MBO 1		1																																												1
MBO 4		1									1																																			2
MBO 9																																						1								1
MBO 10																																		1	1										1	3
MBO 11		1											2																																1	4
MBO 12																																		1	1											2
MBO 15	1	6	1	1	2					4		9			1	10	1		9								1							21	2	1		8	1	1					4	84
MBO 16											1																							1				1								3
MBO 21	4	6	1		2					11	2	3	8	1	2	3	3		2					1										30	4			16	1						9	109
MBO 23															1																			1												2
MBO 27																									1																					1
MBO 28													1																					2												3
MBO 29																																		1												1
MBO 30										1																																				1
MBO 33													1																																	1
MBO 34																																		1												1
MBO 38										1																																				1
MBO 39																																						1								1
MBO 40																																		1												1
MBO 41											1	1		1																																3
MBO 42											1	1																												1						3
MBO 43												3																																		3
MBO 44																																		1												1
MBO 45						1							1																																	2
MBO 47		1										1																						1												3
MBO 48	1									1										1																										3
MBO 49	2	3	1								3									1						1				1									1							13
MBO 50	1							1																																						2
MBO 57	1	3		1			1			2		1				1																					4			1	1					16
MBO 59		2																																												2
MBO 60																																			1											1
MBO 61												1					1																													2
MBO 63	3									1																																				4
MBO 64	1																																													1
MBO 66																																							1	1					1	3
MBO 67																																		1				1								2
MBO 68		1											1																					1				1							1	5
MBO 69	1			1							2					1																		1											1	7
MBO 71			1																																1											2
MBO 72																																		1												1
MBO 74																															1															1
MBO 76	2	1								2			1					1	1													1							3						2	14
MBO 79	1	1																																												2
MBO 80			1																																			1								2
MBO 82																		1																1	1										1	4
MBO 85																																1														1
MBO 86												2																																	1	3
MBO 87																																						2								2
MBO 88																																		1											1	2
MBO 91	1										1																																			2
MBO 93																																						1								1
MBO 94												1																						1				1								3
MBO 95							1			1						1		1																1				1	1							7
MBO 96																																				1										1
MBO 97																																		1												1
MBO 98																																						1								1
MBO 101	1																														1															2
MBO 102													1																																	1
MBO 103																																						1								1
MBO 104		1											1																					2				3	2						1	10
MBO 105		1																																				1							1	3
MBO 106																																						1								1
MBO 107										1																																				1
MBO 109									1							1	1						1				1																1			6
MBO 110											1																							2												3
MBO 111											1																																			1
MBO 120	1												1			1																		1				2	2							8
19PL148		3			2					1	2		5		1				1								1		1					7						1					1	26
19PL155																																		1												1
19PL163	3	6		3	2					11	9	7	12		2	14	10	4	1		1				1								2	29	3	1		13	13	1					8	156
19PL165	6	6	2		1			3		3	10	5	1		1	2				1			1	1	1	1	3			1	1			2					1			1				54
19PL202	10	12		1	2			1		10	3	1			1																3		2	2					3						5	56
19PL203	2	15	1	1	1					8	7	7	7		14	5	2	1							1		1			1	1	2		3	1			2	7						3	93
19PL203-1	4	4					1	1		3	3	2	1		4	3	1		3			1	1				1				1	1		2				1	5						1	44
19PL203-2											1																																			1
19PL203-3	1					1	1				1			1				1	7		1																							1		15
19PL203-4	2																																													2
19PL203-5	3	4					1	1			8	1			1	2			3							1	1			1	3		1											1		32
19PL203-6	6	8	2	3	3	1	4			5	11	2			1	7		1	9			1	2	1	2	1	2	1					5	2					4					1	2	87
19PL203-7	1	2		1						1	1	1	1																																	8
19PL203-8	69	119	10	23	23	4	6	9	1	75	54	38	30	5	29	7	4	13	39	1	4	7	1	1	1	3	4				12	3	11	42	2	2	1	13	25	12		1	1		24	729
19PL203-B										1			3																					6						1					1	12
19PL291	5	12		1	2	1				17	11	11	14	2	9	8	1								1			1						20	3			33	16	2			1		14	185
19PL397																																						2							12	14
19PL409																											3											4							3	10
19PL411													2	1													3							1				4							4	15
19PL412													1		1																			2											8	12
19PL414														2													4							14				2							26	48
19PL520	1	1		1	1					1	2				2	1			1															1				1								13
19PL585	1											1						3																				1								6
19PL588											1																																			1
19PL592										1			1																			1		3	1			3	1							11
	135	221	20	37	41	8	15	16	2	162	138	99	96	13	70	67	24	26	76	4	6	9	6	4	8	7	25	2	1	4	23	9	21	213	21	5	5	123	87	21	1	2	3	3	137	2016

TABLE FOUR

PROJECTILE POINTS FROM MIDDLEBOROUGH SITES

SITE NAME	CLOVIS	EDEN	PARALLEL STEM	HARDAWAY DALT	GREENBRIER	KIRK C NOTCH	KIRK STEMMED	BIFURCATE	NEVILLE	NEVILLE VAR.	STARK	MERRIMACK	OTTER CREEK	BROAD EARED	BREWERTON S-N	BREWERTON E-N	VOSBURG	SYLVAN S-N	BREWERTON ET	SQUIB. TRI.	BEEKMAN TRI.	SMALL STEMMED	LAMOKA	PORT MAITLAND	ATLANTIC	GENESSEE	SUSQ. BROAD	WAYLAND NOTCH	NORMANSKILL	CEREMONIAL BL	ORIENT FISHTL	ROSSVILLE	ADENA	FULTON TURKEY	MEADOWOOD	LAGOON	GREENE	FOX CRK STEM	FOX CRK LANC	JACKS RF PENT	JACKS RF CIN	LEVANNA	MADISON	PREFORMS	FRAGMENTS	TOTAL
MBO 3																						2																								2
MBO 4												1																																		1
MBO 6																																										1				1
MBO 7																						1																								1
MBO 8												1																																		1
MBO 15					1		1		4	2	3	3				1			2	9	1	10											1			2	1		1		1	3		8	13	67
MBO 16											1																		1				1													3
MBO 17																						1																								1
MBO 19												1																																		1
MBO 20																																										1				1
MBO 21			1				1		4	1					2	1			3	12		5			3		1	1	1		1	1			1		1		1			11			13	65
MBO 24									1	1										3		3					2									1						2			1	14
MBO 25									1			1			1					10																									1	14
MBO 26																				10		8			1											1				1		1	3			25
MBO 31																						1																								1
MBO 32																									1				1		1															3
MBO 37												1																																		1
MBO 48										1		1								1	1	3			1							1										1			1	11
MBO 49				1					2	1		3				1				8	2	9			1	1		2	1		1	1				1	1			1	1	3	1	2		44
MBO 55																																										3				3
MBO 56																	1																												1	2
MBO 57						1			3	1	1	2	2		1	1			2	5		3			3	1	1									2		1			2	3	3	1	3	42
MBO 59				1							2									7		4				1			1		3	1			1	2	1	1	1	1		2	1		1	31
MBO 61									2												2	1			1		1	1	1			1		1						1		2				14
MBO 62												1								3	1	2																								7
MBO 63												1								1		1																				1			1	5
MBO 64			1								1	1								3	1	4									6					3									1	21
MBO 65																																1														1
MBO 73																																							1							1
MBO 74												1								1		2																								4
MBO 75																															1															1
MBO 76										1					2					2		3			2						5				1		2					5			5	28
MBO 77																						2																								2
MBO 78																									1			1												1		1				4
MBO 79												1								2																										3
MBO 81																														1																1
MBO 84																						5																					1			6
MBO 85		1							2															1						1	1													1		7
MBO 90													1						2											1																4
MBO 91																		1							1			1	1																	4
MBO 92										1										1												1			1											4
MBO 99																	1																													1
MBO 100																									2																					2
MBO 101												4	1							4		4			1	1										1						2			1	19
MBO 108																													1																	1
MBO 109																1				1												1						1	1						1	6
MBO 118																															1															1
19PL148									2	3	1	1			1				2	9	1	11				1			3	3	2	1						1	1			11		2	7	63
19PL155																																													1	1
19PL163								1	1	2										10	2	11			2							1						2		1		6		2	10	51
19PL165	1	1	1	3	1		3	13	7	5	5	3	2	1	7	3	2	1	2	11	5	7			16	3	7	7	5	4	7	7	1		12	1	3	5	2	10	10	18	8	3	6	219
19PL202									1	1	2	13				1	1			5		37			1			1	1		1				1	10	3	1	1	1		2		1	21	106
19PL203				1						2										3		5									2	1				1	1			1		6				23
19PL203-1											2									9	2	1			1			1			1									1						18
19PL203-2							1		1										3	2	1	3														1										12
19PL203-3												2				3				4											2															11
19PL203-4																	1					1																							1	3
19PL203-5									2	2		7			4		1		2	9	1	12	1		1		2	3			3				1	4	2		1	2		2				62
19PL203-6						2			8	3	4	8	1		4	3	4	3	5	15		21			3	1		2		4	4	2				1	2	2	10	4	1	5	3		6	131
19PL203-7																				6		4														1						1			1	13
19PL203-8	7	2		1		1	1	2	36	29	67	57	11		1	5	2		3	59	3	304			5		1	5	2	29	6	18			4	35	8	1	1	12		13	18	19	98	866
19PL203-B				1							1				1					1																1				1	2				1	9
19PL291																				5		9			1													1		1		15	1	4	20	57
19PL397																									1																				11	12
19PL409																				3																									1	4
19PL411									2	1										3		1																							3	10
19PL412									1		1											2																							3	7
19PL414										2										4		14																							8	28
19PL421																			1	1		.																								2
19PL520							1		1			1								3		1			1	1			1			1							1			2				14
19PL585																						1																					3			4
TOTALS	8	4	3	8	2	4	8	16	81	59	91	115	18	1	24	20	13	5	27	245	23	519	1	1	50	10	15	25	20	43	48	39	3	1	22	68	25	16	22	39	17	123	42	43	241	2208

TABLE TWO
MIDDLEBOROUGH PREHISTORIC INVENTORY
ENVIRONMENTAL PARAMETERS

SITE #	ELEVATION A.S.L.	DRAINAGE	ASPECT	DISTANCE TO WATER	HYPSOMETRIC INTEGRAL	STREAM RANK	SOIL TYPE	SLOPE
MBO 1	110	NEMASKET	SE	650	.61	1	MERRIMAC	1
MBO 2	45	NEMASKET	N	50	.25	1	SACO	1
MBO 3	80	WEWEANTIC	N	25		2	CARVER	1
MBO 4	85	WEWEANTIC	E	160		1	CARVER	1
MBO 5	80	WEWEANTIC	NE	25		2	CARVER	1
MBO 6	90	WINNETUXET	NE	300	.56	1	HINCKLEY	3
MBO 7	35	NEMASKET	S	25	.18	11	WINDSOR	1
MBO 8	70	WINNETUXET	S	350	.44	1	WINDSOR	2
MBO 9	70	NEMASKET	SW	140	.44	2	GLOUCESTER	1
MBO 10	110	NEMASKET	SW	375	.61	1	GLOUCESTER	1
MBO 11	50	NEMASKET	N	25	.34	4	SACO	1
MBO 12	65	PONDS	SE	75	.40	1	WINDSOR	1
MBO 13	70	POQUOY	W	25	.44	1	HINCKLEY	1
MBO 14	65	POQUOY	SW	75	.40	2	WINDSOR	1
MBO 15	45	NEMASKET	W	130	.25	1	WINDSOR	1
MBO 16	35	TAUNTON	NW	75	.18	19	AGAWAM	1
MBO 17	40	TAUNTON	NW	100	.20	1	SCARBORO	1
MBO 18	80	NEMASKET	N	125	.54	4	HINCKLEY	2
MBO 19	75	NEMASKET	E	125	.46	4	RAYNHAM	1
MBO 20	110	NEMASKET	E	125	.61	2	ESSEX	2
MBO 21	60	NEMASKET	SW	70	.39	3	WINDSOR	1
MBO 22	85	NEMASKET	W	175	.55	2	DEERFIELD	2
MBO 23	105	WINNETUXET	N	50	.59	2	MERRIMAC	1
MBO 24	70	MATTAPOISETT	N	250		6	ESSEX	2
MBO 25	50	NEMASKET	SE	100	.34	4	WINDSOR	1
MBO 26	40	NEMASKET	E	75	.20	5	WINDSOR	1
MBO 27	70	POQUOY	SE	100	.44	1	WINDSOR	1
MBO 28	30	NEMASKET	W	25	.16	15	GLOUCESTER	1
MBO 29	120	NEMASKET	N	375	.63	1	MERRIMAC	1
MBO 30	85	NEMASKET	SE	200	.55	4	UNCLASS.	1
MBO 31	90	NEMASKET	E	275	.56	4	WINDSOR	1
MBO 32	100	NEMASKET	N	400	.58	7	ESSEX	1
MBO 33	140	NEMASKET	S	650	.70	1	HINCKLEY	3
MBO 34	150	NEMASKET	SW	875	.77	1	HINCKLEY	2
MBO 35	95	WEWEANTIC	E	120		1	CARVER	1
MBO 36	60	NEMASKET	NW	75	.39	3	WINDSOR	1
MBO 37	80	NEMASKET	NE	125	.54	10	ESSEX	3
MBO 38	65	NEMASKET	W	150	.40	4	HINCKLEY	2
MBO 39	90	NEMASKET	NW	50	.56	2	HINCKLEY	1
MBO 40	90	WEWEANTIC	E	10		2	GLOUCESTER	1
MBO 41	110	WEWEANTIC	E	75		1	GLOUCESTER	1
MBO 42	135	PONDS	SW	800	.67	1	GLOUCESTER	1
MBO 43	130	PONDS	W	450	.65	1	GLOUCESTER	1
MBO 44	130	NEMASKET	NE	100	.65	1	GLOUCESTER	2
MBO 45	140	NEMASKET	E	400	.70	1	ESSEX	1
MBO 46	60	WINNETUXET	NW	120	.39	1	MERRIMAC	1
MBO 47	90	WINNETUXET	SW	50	.56	1	HINCKLEY	1
MBO 48	95	WEWEANTIC	N	375		1	CARVER	1
MBO 49	40	NEMASKET	S	50	.20	10	WINDSOR	2
MBO 50	80	PONDS	W	225	.54	1	WINDSOR	1
MBO 51	35	NEMASKET	W	25	.18	5	SACO	1
MBO 52	120	NEMASKET	W	400	.63	8	GLOUCESTER	1
MBO 53	100	NEMASKET	SW	425	.58	1	MERRIMAC	1
MBO 54	95	NEMASKET	E	275	.57	9	WINDSOR	1
MBO 55	60	NEMASKET	W	50	.39	5	HINCKLEY	2
MBO 56	50	PONDS	S	25	.34	2	SCARBORO	1
MBO 57	30	TAUNTON	NW	175	.16	19	WAREHAM	1
MBO 58	95	PONDS	W	325	.57	1	WINDSOR	1
MBO 59	60	NEMASKET	N	125	.39	11	WINDSOR	2
MBO 60	100	NEMASKET	SW	100	.58	1	SCARBORO	3
MBO 61	60	NEMASKET	SE	25	.39	3	SACO	2
MBO 62	95	NEMASKET	S	300	.57	4	HINCKLEY	3
MBO 63	80	NEMASKET	SE	140	.54	4	WINDSOR	2
MBO 64	80	NEMASKET	NW	110	.54	4	HINCKLEY	2
MBO 65	110	NEMASKET	SE	575	.61	4	UNCLASS.	1
MBO 66	80	NEMASKET	N	25	.54	1	GLOUCESTER	1
MBO 67	85	NEMASKET	SW	300	.55	6	ESSEX	2
MBO 68	135	NEMASKET	W	100	.67	1	GLOUCESTER	1
MBO 69	145	NEMASKET	NE	625	.75	1	GLOUCESTER	1
MBO 70	100	PURCHADE	W	50	.58	2	HINCKLEY	1
MBO 71	50	WINNETUXET	E	150	.34	2	SCARBORO	1
MBO 72	75	PURCHADE	NE	500	.46	1	ESSEX	1
MBO 73	60	WINNETUXET	NE	50	.39	2	MERRIMAC	1
MBO 74	130	NEMASKET	W	150	.65	2	SCARBORO	2
MBO 75	70	MATTAPOISETT	E	125		2	SCARBORO	1
MBO 76	70	WINNETUXET	SW	125	.44	2	HINCKLEY	2
MBO 77	100	WEWEANTIC	S	60		1	CARVER	1
MBO 78	90	NEMASKET	SW	850	.56	1	DEERFIELD	1
MBO 79	80	PONDS	SE	200	.54	1	WINDSOR	1
MBO 80	65	POQUOY	S	525	.40	1	SCITUATE	1
MBO 81	50	NEMASKET	N	50	.34	12	WINDSOR	2
MBO 82	50	WINNETUXET	N	500	.34	1	GLOUCESTER	2
MBO 83	90	PONDS	W	300	.56	1	WINDSOR	1
MBO 84	105	NEMASKET	W	20	.59	2	MERRIMAC	1
MBO 85	85	WINNETUXET	NW	150	.55	1	MERRIMAC	1
MBO 86	85	SIPPICAN	SE	25		2	SCARBORO	1
MBO 87	40	NEMASKET	NW	125	.20	2	WINDSOR	1
MBO 88	75	POQUOY	N	150	.46	1	HINCKLEY	1
MBO 89	85	PONDS	SW	20	.55	1	WAREHAM	1
MBO 90	30	TAUNTON	NW	200	.16	19	MERRIMAC	1
MBO 91	30	TAUNTON	N	25	.16	3	MERRIMAC	1
MBO 92	55	TAUNTON	W	75	.36	1	ESSEX	1
MBO 93	30	NEMASKET	E	50	.16	13	GLOUCESTER	1
MBO 94	30	NEMASKET	E	75	.16	14	GLOUCESTER	1
MBO 95	35	NEMASKET	E	75	.18	16	GLOUCESTER	1
MBO 96	115	WEWEANTIC	S	20		2	HINCKLEY	1
MBO 97	85	NEMASKET	SW	20	.55	1	GLOUCESTER	1
MBO 98	120	WEWEANTIC	E	125		2	HINCKLEY	1
MBO 99	100	NEMASKET	W	225	.58	1	MERRIMAC	1
MBO 100	60	PONDS	S	10	.39	2	SCARBORO	2
MBO 101	50	TAUNTON	S	150	.34	22	NORWELL	2
MBO 102	100	NEMASKET	NW	225	.58	4	HINCKLEY	2
MBO 103	90	NEMASKET	SW	500	.56	3	HINCKLEY	1
MBO 104	110	NEMASKET	S	450	.61	1	GLOUCESTER	1
MBO 105	110	NEMASKET	SW	650	.61	1	GLOUCESTER	2
MBO 106	110	TAUNTON	NE	850	.61	1	GLOUCESTER	1
MBO 107	110	TAUNTON	S	725	.61	1	AGAWAM	1
MBO 108	60	PONDS	S	25		2	DEERFIELD	2
MBO 109	20	TAUNTON	N	25	.11	19	AGAWAM	1
MBO 110	25	TAUNTON	N	25	.14	20	BELGRADE	1
MBO 111	90	MATTAPOISETT	SW	250		3	ESSEX	2
MBO 112	75	NEMASKET	SW	200	.46	6	HINCKLEY	2
MBO 113	60	NEMASKET	S	50	.39	4	HINCKLEY	3
MBO 114	45	NEMASKET	NE	20	.25	4	SACO	1
MBO 115	95	NEMASKET	W	150	.57	1	WINDSOR	1
MBO 116	35	NEMASKET	W	20	.18	1	WINDSOR	2
MBO 117	150	NEMASKET	SE	575	.77	1	HINCKLEY	2
MBO 118	90	MATTAPOISETT	E	75		1	MERRIMAC	1
MBO 119	60	PURCHADE	NE	250	.39	1	ESSEX	1
MBO 120	35	WINNETUXET	SW	100	.18	1	WINDSOR	1
19PL148	75	NEMASKET	N	100	.46	4	HINCKLEY	2
19PL155	25	TAUNTON	N	100	.14	14	AGAWAM	1
19PL163	45	TAUNTON	NW	50	.25	20	MERRIMAC	2
19PL165	30	TAUNTON	W	150	.16	20	AGAWAM	1
19PL202	100	PONDS	SE	225	.58	1	GLOUCESTER	1
19PL203-B	70	PONDS	S	10	.37	2	WINDSOR	1
19PL203-U	70	PONDS	S	50	.44	2	WINDSOR	1
19PL203-1	70	PONDS	S	50	.44	2	WINDSOR	1
19PL203-2	70	PONDS	S	50	.44	2	WINDSOR	1
19PL203-3	70	PONDS	S	50	.44	2	WINDSOR	1
19PL203-4	70	PONDS	S	50	.44	2	WINDSOR	1
19PL203-5	70	PONDS	S	50	.44	2	WINDSOR	1
19PL203-6	70	PONDS	S	50	.44	2	WINDSOR	1
19PL203-7	70	PONDS	S	50	.44	2	WINDSOR	1
19PL203-8	55	PONDS	SE	50	.44	2	WINDSOR	1
19PL291	70	NEMASKET	SW	125	.44	1	MERRIMAC	2
19PL397	120	WINNETUXET	E	175	.63	1	HINCKLEY	2
19PL409	50	NEMASKET	SW	150	.34	1	GLOUCESTER	1
19PL411	30	NEMASKET	SW	100	.16	17	MERRIMAC	1
19PL412	25	TAUNTON	N	75	.14	7	BELGRADE	1
19PL414	65	WINNETUXET	NW	75	.40	1	GLOUCESTER	1
19PL421	40	NEMASKET	W	75	.20	10	BIRDSALL	1
19PL482	30	POQUOY	S	75	.16	3	WINDSOR	2
19PL520	70	NEMASKET	SE	75	.44	4	RAYNHAM	1
19PL531	75	NEMASKET	S	200	.46	1	GLOUCESTER	2
19PL535	25	POQUOY	SE	100	.14	9	MERRIMAC	1
19PL585	70	PONDS	SW	225	.44	2	GLOUCESTER	1
19PL588	110	NEMASKET	SW	500	.61	4	ESSEX	1
19PL589	110	SIPPICAN	N	250		1	GLOUCESTER	1
19PL590	110	SIPPICAN	E	275		1	GLOUCESTER	2
19PL591	110	SIPPICAN	NW	250		1	GLOUCESTER	2
19PL592	110	SIPPICAN	SW	275		1	GLOUCESTER	1
19PL593	110	SIPPICAN	W	225		1	GLOUCESTER	1
19PL594	110	SIPPICAN	E	175		1	GLOUCESTER	1
19PL595	100	SIPPICAN	SE	150		1	GLOUCESTER	1
19PL596	110	SIPPICAN	W	350		1	GLOUCESTER	2
19PL597	100	SIPPICAN	W	300		1	GLOUCESTER	1
19PL598	90	SIPPICAN	W	175		1	GLOUCESTER	1
19PL599	90	SIPPICAN	W	175		1	GLOUCESTER	1